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A RECORD OF THE PART OF THE DEPARTMENT OF AGRICULTURE IN THE EUROPEAN WAR, 1914-19.

We have certainly been remiss in failing to publish until now—almost a year after the cessation of hostilities—a list of the names of the members of the staff of the Department of Agriculture who enlisted for service in the terrible war which has just been triumphantly declared at an end. Unfortunately the list which can be given is incomplete. Full information is available of enlistments from all our branches except the Maffra Sugar Factory. Many men, and youths too, from the factory, who were accepted for service, did not notify the management, but simply ceased duty in a casual way and enlisted.

In stating the number of enlistments from the Department as 197, account has been taken of those employees at Maffra who are known to have enlisted, but in the list hereunder, so that no invidious distinctions may be made, the names of none of the soldiers from the Factory are included.

Name.	Branch.	Battalion, &c.
Allen, D. T. ..	Government Farm, Wyuna ..	14th Battalion
Allsop, C. H. ..	School of Primary Horticulture, &c., Burnley	2nd Pioneers
Anderson, A. F. ..	State Research Farm, Werribee	58th Battalion
Bailes, J. ..	State Research Farm, Werribee	
Baillie, F. ..	Viticultural College, Rutherglen	In camp when Armistice signed
Baker, H. A. ..	Produce Division	22nd Battalion
Bennett, W. J. ..	Stock and Dairy Division ..	2nd Light Trench Mortar Battery.
Blazey, C. (M.Sc.)	Field Officer	
Bodey, F. ..	Viticultural College, Rutherglen	
Brake, J. (B.Ag.Sc.)	State Research Farm, Werribee	
Brown, W. ..	Produce Division	Did not embark. Discharged owing to ill-health
Cahill, A. (M.M.) ..	Viticultural College, Rutherglen	3rd Australian Field Ambulance

Name.	Branch.	Battalion, &c.
Carmody, J. A. ..	Produce Division	4th Field Artillery
Carnegie, W. B. ..	Produce Division	57th Battalion
Clarke, J. G. L. ..	Viticultural College, Rutherglen	7th Battalion
Collier, W. ..	Viticultural College, Rutherglen	37th Battalion
Collins, L. J. (enlisted under name of Rogers)	Correspondence Branch ..	23rd Battalion, 6th Reinforcements
Cronin, M. ..	Vineyard Manager	Enlisted for Home Service when, owing to age, his offer to enlist in the A.I.F. was rejected
Dudderidge, G. ..	Viticultural College, Rutherglen	107th Howitzer Battery
Dunn, W. A. ..	Viticultural College, Rutherglen	14th Australian Field Ambulance
Eggleston, H. .. (M.M.)	Viticultural College, Rutherglen	2nd Australian Tunnelling Coy.
Flynn, J. ..	Viticultural College, Rutherglen	
Fraser, C. E. ..	Accounts Branch	Australian Flying Corps
French, C. ..	Produce Division	Chief Refrigerating Engineer, H.M.A.T. *Boonah*
Gillespie, R. M. (B.Ag.Sc.)	Field Officer	6th Battalion
Girond, L. ..	Viticultural College, Rutherglen	8th Light Horse
Greene, J. P. ..	Produce Division	26th Battalion
Gresson, G. L. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Hadfield, E. G. ..	State Research Farm, Werribee	
Hanlon, J. W. ..	Stock and Dairy Division ..	4th Battalion
Harrison, C. K. ..	Stock and Dairy Division ..	1st Anzac Mounted Regiment
Hayes, R. F. ..	Produce Division	29th Battalion
Herbert, W. V. ..	State Research Farm, Werribee	
Heslop, G. G. (D.S.O.)	Stock and Dairy Division ..	Australian Army Veterinary Corps
Hoare, R. ..	Viticultural College, Rutherglen	
Hogan, W. (D.C.M.)	Viticultural College, Rutherglen	1st Brigade, 4th Battalion
Hossack, R. ..	Viticultural College, Rutherglen	57th Battalion
Houlihan, T. F. ..	Stock and Dairy Division ..	3rd Divisional Engineers
Ingham, L. P. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Irwin, L. ..	Viticultural College, Rutherglen	12th Reinforcements G.S.G.
Johnson, H. E. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Johnstone, R. N. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Jones, L. ..	State Research Farm, Werribee	
Kearnan, B. ..	Viticultural College, Rutherglen	
Kendall, E. O. (C.M.G.)	Stock and Dairy Supervision ..	Deputy Director, Veterinary Services, A.I.F.
Knowles, J. H. ..	Government Farm, Wyuna	
Laycock, R. S. (M.M.)	Correspondence Branch ..	7th Battalion
Levy, J. M. ..	Field Officer	"A" Coy., 23rd Battalion
Marks, L. ..	Viticultural College, Rutherglen	
Massey, W. ..	State Research Farm, Werribee	
McCormick, S. ..	School of Primary Agriculture, &c., Burnley	
McKenzie, R. T. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
McLean, R. ..	Viticultural College, Rutherglen	
McMillan, A. ..	Viticultural College, Rutherglen	
McNamara, D. V. ..	Accounts Branch	Army Pay Corps

Name.	Branch.	Battalion, &c.
Morton, C. J. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Mowatt, P. H. ..	Viticultural College, Rutherglen	2nd Siege Battery, 1st Division
Neal, E. H. ..	Correspondence Branch ..	6th Battalion
Newman, J. ..	Viticultural College, Rutherglen	In camp when Armistice was signed
Newton, J. ..	Viticultural College, Rutherglen	57th Battalion
Nicholson, A. ..	Government Farm, Wyuna	
Oats, B. J. ..	Viticultural College, Rutherglen	37th Battalion
Oldfield, N. ..	Viticultural College, Rutherglen	
Oliver, J. D. ..	Stock and Dairy Division ..	39th Battalion; was invalided home and discharged, but re-enlisted and held a Commission in 10th French Mortar Battery
Orth, P.	Agricultural Laboratory ..	Did not embark; was discharged on signing of Armistice
Palethorpe, J. ..	Viticultural College, Rutherglen	7th Battalion
Pappin, J. ..	Viticultural College, Rutherglen	
Parratt, P. T. ..	Correspondence Branch ..	4th Divisional Ammunition Column
Patterson, S. E. ..	Viticultural College, Rutherglen	118th Battery, 23rd F.A. Bde.
Porter, E. ..	State Research Farm, Werribee	
Powers, E. ..	Produce Division	2nd Field Company Engineers
Pritchard, L. B. (B.Ag.Sc.)	Field Officer	22nd Battalion
Rippingale, J. ..	Viticultural College, Rutherglen	48th Battery, 12th Brigade
Rowlands, J. D. ..	Accounts Branch	24th Battalion
Ryan, D. ..	Government Farm, Wyuna ..	
Scott, J.	Government Farm, Wyuna ..	
Sherlock, S. ..	Stock and Dairy Division ..	Australian Army Veterinary Corps
Simpson, A. ..	Produce Division	Did not embark; discharged owing to illness
Slow, G.	Viticultural College, Rutherglen	7th Battalion
Smith, A. ..	Viticultural College, Rutherglen	In camp when Armistice was signed
Speers, E. ..	Viticultural College, Rutherglen	54th Battalion
Spittal, C. E. ..	Correspondence Branch ..	Army Pay Corps
Stone, J. ..	Viticultural College, Rutherglen	
Talbot, R. J. de C.	Viticultural College, Rutherglen	Australian Army Veterinary Corps
Taylor, L. J. ..	Stock and Dairy Division ..	38th Battalion
Taylor, V. ..	Viticultural College, Rutherglen	4th Pioneer Batt.
Thomas, W. A. ..	Produce Division	14th Battalion
Thornton, R. ..	Viticultural College, Rutherglen	2nd Battalion, and late 37th Battalion
Thynne, J. T. ..	Correspondence Branch ..	1st Divisional Artillery H.Q.
Tulloh, I. M. ..	Field Officer	23rd Battalion
Turner, R. ..	State Research Farm, Werribee	5th Pioneer Battalion
Vaughan, C. ..	Viticultural College, Rutherglen	8th Light Horse
Vaughan, E. ..	Viticultural College, Rutherglen	23rd Battery
Walker, W. ..	Viticultural College, Rutherglen	In camp when Armistice was signed
Warren, L. ..	Viticultural College, Rutherglen	12th Field Artillery
Wedge, C. H. ..	School of Primary Agriculture, &c., Burnley	Wireless Telegraph Operator, R.A.N. Radio Service
Wickham, F. H. ..	Accounts Branch	Army Pay Corps
Williams, A. ..	Viticultural College, Rutherglen	In camp when Armistice was signed

Those Who Will Not Return.

Though with the re-establishment of peace the horror of the long four years of desolation and sorrow is for most being slowly withdrawn, we still remember that sixty thousand Australian soldiers have laid down their lives in Gallipoli and France, and that tens of thousands—no one can guess how many—have suffered in mind and body.

Of the officers of the Department of Agriculture who enlisted ten will never return—

ALLAN, D. T. Was a Graduate of the Dookie Agricultural College, and at the time of his enlistment in October, 1914, was engaged in cereal breeding at the Government Farm at Wyuna. Much was expected from the results of Corporal Allan's investigations, and it was only his response to the Empire's call that prevented the performance of work that would have been of service to the whole State. He held the rank of Lance-Corporal in the 14th Battalion when he was killed at Gallipoli in August, 1915.

ANDERSON, A. F. Was employed at the Research Farm, Werribee, at the time of his enlistment early in 1916. He held the rank of Sergeant in the 53th Battalion when he was killed in France, 2nd September, 1918.

COLLINS, Leslie J. Enlisted under the name of Rogers, the name of his step-father. Embarked with the 23rd Battalion, 6th Reinforcements, in September, 1915. Killed in France, 4th August, 1916.

FLYNN, J., Sergeant. Was employed immediately prior to his enlistment at the Viticultural College, Rutherglen.

GILLESPIE, Robert M. (B. Ag. Sc.). Sergeant, 6th Battalion. Sergeant Gillespie was appointed to the Department of Agriculture shortly after obtaining his degree at the Melbourne University. He gave valuable assistance in the work of laying out the experimental plots when the Research Farm was inaugurated at Werribee, and later was appointed to the position of Experimentalist. He was a man of great promise, and his death was a loss to the Agricultural interests of the State. Sergeant Gillespie, who enlisted immediately after the outbreak of war, was killed at the historic landing on the 25th April, 1915.

LAYCOCK, Raymond S. Formerly a Junior Clerk in the Correspondence Branch, was attached to the 7th Battalion when he embarked in August, 1915. Owing to his small stature young Laycock was unable to enlist until the required height was reduced to 5 ft. 2 in. In his nineteenth year he was serving on Gallipoli. He took part in both the Somme offensives, and after Pozieres was made a Corporal. In the advance on Bapaume in March, 1917, he was promoted Sergeant on the field, and awarded the Military Medal. Sergeant Laycock was killed in France on the 23rd September, 1917.

OLIVER, James D. Was a Dairy Supervisor in the Live Stock Division. He enlisted immediately after the commencement of war, and left Australia in October, 1914, as a member of "B" Company, 5th Battalion. In Egypt he contracted pneumonia, was invalided home and discharged, and for some time acted as House Master at the Viticultural College, Rutherglen. Mr. Oliver enlisted for the second time in December, 1915, and embarked in May, 1916, as a Sergeant in the 39th Battalion. In France he became a Commissioned Officer in a Trench Mortar Battery. Was killed in action 4th October, 1917.

PRITCHARD, Leslie B. (B. Ag. Sc.). Enlisted June, 1915, became a 2nd Lieutenant in the 22nd Battalion. He held the degree of B.Ag.Sc. of the Melbourne University, and during most of the period of his employment in the Department of Agriculture was engaged in plant breeding at Werribee. His training and point of view made him eminently suited for the experimental work allotted to him, and, as in the cases of Corporal Allan and Sergeant Gillespie, his death was a great loss to our State Agricultural interests.

ROWLANDS, James D. Was a Clerk in the Accounts Branch. He was a lad of manly and self-reliant spirit, and has left a memory honoured not only amongst his office associates, but throughout all the Department. Sergeant Rowlands enlisted 14th July, 1915, and left Australia as a Corporal in the 24th Battalion. Was severely wounded at Pozieres at the end of 1916. After several months in hospital Corporal Rowlands returned to France, where he was killed on the 5th October, 1918.

TURNER, R. Was employed as a Carpenter at the Research Farm, Werribee. Enlisted 17th July, 1915, and embarked with the 5th Pioneer Battalion. Was killed in France 9th March, 1917.

HONOURS WON.

Of those members of the staff of the Department of Agriculture who enlisted for active service six gained distinctions. The honour of C.M.G. was conferred on Colonel E. A. Kendall, Director of Veterinary Services to the A.I.F., and Major G. G. Heslop gained the distinction of D.S.O. The Military Medal was awarded to Private A. Cahill and Corporal H. E. Eggleston and, as already mentioned, to the late Sergeant R. S. Laycock, and the Distinguished Conduct Medal was won by Sergeant W. Hogan.

"BEHIND THE LINES."

It has been said that wars are won from behind the lines—that the sphere of the soldier who is ready to fling away his life in battle is less important than that of the man engaged in the unheroic task of maintaining supplies of food. But no one will press this opinion, and perhaps it can be best said that there are various forms of service, "but the same spirit." It will not therefore be out of place to make a brief mention of some of the work of the Department of Agriculture in facilitating the supply of foodstuffs to help to meet the requirements of the armies of the Empire and her allies.

During the period of war the Department undertook the purchase and shipping of supplies on behalf of the Imperial Government. Beef, mutton, and lamb to the value of approximately £2,000,000 sterling was purchased for the Imperial Government and shipped. About 14,500,000 rabbits, half of which came from adjoining States, were sent away. Several contracts for the supply of jam were entered into through the Department during 1916 and onwards, and the total quantity forwarded from the State was about 76,000,000 lbs., the value of which was estimated at £1,500,000. In addition, 5,000,000 lbs. of canned fruit were shipped. Hundreds of tons of cheese were bought on behalf of the British Government, and large quantities of eggs were obtained and packed for the Defence Department. Further service was rendered in inspecting the wheat and flour purchased by Great Britain, and in supervising the export of oatmeal, vegetables, fruit, &c., for the Defence Department, the Red Cross Society, and the Comforts Fund to various centres in England, Egypt, France, Rabaul, and Samoa.

PEAR GROWING IN VICTORIA.

(Continued from page 216.)

By E. Wallis, Orchard Supervisor.

Draining the Land.

In the work of preparing the soil for the reception of the young pear trees, the importance of establishing a proper system of artificial drainage should receive prompt and thorough attention.

It may be that the land to be planted has the advantage of being naturally drained, but such cases are by no means common, and, in fact, it is hard to find an area of, say, twenty acres where perfect natural drainage conditions obtain throughout the whole. In much of our orchard country the soil is of a patchy nature, and, even in a small compass, may differ in its physical composition, from the light residual to

Plate 17.- Sub-soiling Operations.

the heavy and compact soil. If, as previously recommended, the pear, on account of its hardy nature, is to be planted under the harsher soil conditions, reserving the more kindly soil for the less hardy kinds of fruit, artificial drainage will be necessary to assist the trees to yield maximum results. In fact, even the light alluvial soils, owing to seepage and other causes, are often found to require draining by artificial means.

The stunted appearance and, in some cases, actual die-back of the trees in many of our established orchards bear witness to the neglect of thorough soil preparation, such as drainage and sub-soiling, when trees were planted, for, notwithstanding the natural hardiness of the pear tree, it cannot be expected to thrive and prove profitable under water-logged and impervious soil conditions.

It should be remembered that the work of soil preparation, in which drainage plays such an important part, together with sub-soiling and

planting of proper varieties on scientific lines, is really the laying of the orchard's foundation, and, as with a house, the superstructure cannot be lasting or satisfactory unless the foundation is properly laid. When attention to the matter of soil-preparation is being given, it is well to consider the dual operations of sub-soiling and drainage as supplementary to each other. A drainage scheme complete in every detail would be rendered quite ineffective unless any existing hard-pan or impervious clay sub-soil were broken through. Either of these conditions would be quite sufficient to provide a permanent water-table in itself, though perhaps only a few inches from the surface, whereas if such impediments were removed and artificial drainage established the water-table would establish itself at the level of the drains, thus deepening the root-bed for trees perhaps several feet. By referring to the diagram as shown in plate 17A, this will be more clearly seen. Without proper drainage sub-soiling is not lasting in its effects, but with drainage the stirred soil, through the action of water filtration, aeration, and other agencies, remains in a loosened condition. In fact, drainage means permanent sub-soiling.

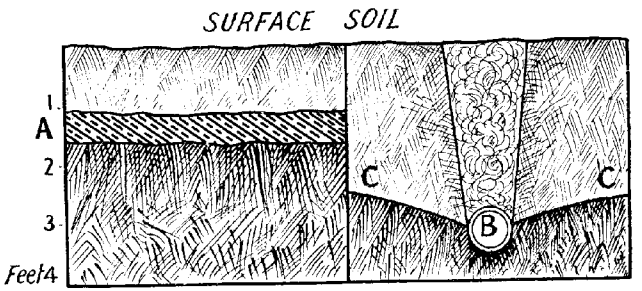


Plate 17a.

A. Existing hard-pan. B. Drain laid in area similar to A, but with hard-pan broken up. C. Water-table lowered by drainage.

The deepening of the root-bed, as explained, means much to pear trees, which are naturally of a deep-rooting habit, and it will be readily understood that the more extensive the root ramification the better will be the development of the trees. Thus, within certain limits, the profit-earning capacity of the trees will be considerably augmented, which is tantamount to the area itself being increased; for ten acres of pear trees, growing under ideal drainage conditions, and participating in all the benefits derivable therefrom, would probably yield as much as twenty acres of trees growing under the unfavourable conditions referred to above.

Regular Development of Trees.

So definite is the action of proper soil-drainage upon the regular development of the trees, that the expert eye can detect at a glance along the rows whether the trees are growing in land thoroughly drained or not. In undrained land, where wet patches exist, it will generally be found that the growth and uniform development of trees are materially

affected. Here and there stunted, unhealthy trees will be seen, while in some positions, having the advantage of natural drainage, perhaps even in the same row as their sickly neighbours, the trees will make good growth and probably build up a fine framework, and bear heavy crops of fruit. A thorough system of artificial drainage remedies this defect of patchy tree-development, with its consequent profit-leakage, and enables the rows of trees to develop regularly and uniformly, thus making it possible for maximum results in cropping to be achieved.

Without such regularity in the development of the rows of trees, and notwithstanding all the attention which may be given to scientific pruning, cross-fertilization, and other details of orchard practice, the crop of pears per acre must be considerably reduced.

Plate 18.—Regular tree development, due to proper drainage.

Access to Land.

In undrained land after heavy rains the soil remains boggy until the water has evaporated. This unfavourable condition often hinders cultural operations till late in the spring, and prevents the growth of winter crops for green manuring purposes. Whereas, under the better conditions brought about by drainage, the land soon parts with its surplus water, even in winter, and enables any seasonal orchard operations to be proceeded with satisfactorily at the proper time.

Effect of Bad Drainage upon Pear Scab and Root Borer.

More difficulty is experienced in ridding pear trees of Pear Scab when the trees are growing in "wet" soil. Probably this is partly due to the increased humidity in early spring caused by the evaporation of surplus soil water usually found when the land is not properly drained, but which in well-drained land passes off through the soil by the process of filtration.

In the case of pear trees attacked by Root Borer, one of the worst, if not the worst of orchard pests, their natural resisting power is considerably lessened by the wet conditions due to improper drainage, which has impaired the trees' root system. It is found that where a favourable soil condition obtains pear trees, even when attacked by this pest, will show great resisting power and probably remain productive for many years after being infected.

The Root Borer thrives in compact and impervious soil and clay, which allows of its free tunnelling through the soil without the tunnels collapsing as in the case of the more friable conditions produced by proper drainage.

Plate 18a.—Showing hard, lumpy condition of soil due to improper drainage.

Influence of Good Soil-Tilth and Aeration on Trees.

By tilth is meant the ideal soil condition making for the growth of trees, as when the soil particles are comparatively fine and easily broken up, rendering the soil capable of retaining sufficient moisture for use of trees and allowing free access of air deeply into soil. These factors of comparative looseness of soil, moisture, and air mean an ideal environment for growth of trees, providing sustenance for them during times of heavy and continual cropping, and enabling them to better withstand effects of drought. In fact, without such conditions continual cropping would be out of the question, for after a heavy crop it would probably take the trees a season or two to recuperate and build up their fruit buds for another crop. It is this attention to the soil, together with scientific pruning and manuring, that enables some orchardists to obtain regular and heavy crops of pears, whilst others can claim only very intermittent cropping for their trees.

It may be said by some that scientific pruning and manuring are the chief essentials for regular bearing, but, without discrediting the importance of these in any way, it must be recognized that the ideal soil conditions enumerated, and produced mainly through good drainage, are really the governing factors of maximum effects from other orchard operations.

A proper condition of soil-tilth is necessary to enable the oxygen from atmosphere and rain water to penetrate freely through the soil, and this is not possible if a water-logged condition exists, as such soil is sealed against the air. In a well-drained soil, however, this surplus water passes away by filtration and gives place to air in addition to the moisture films surrounding the soil particles. As air is so important in promoting growth, it will be seen how necessary it is to rid the soil of any obstruction to its free passage and consequent aeration of the soil.

It is impossible to maintain a good soil-tilth unless the land is properly drained, as "wet" land becomes hard, lumpy, and dried out in summer time, when a good state of soil-tilth is so essential to moisture

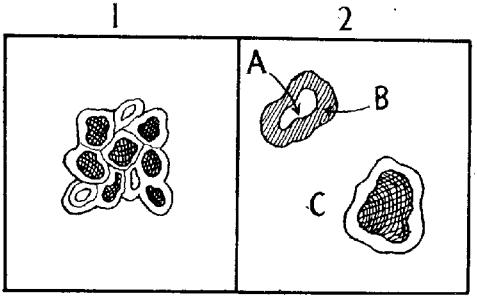


Plate 19.

1.—Soil grains and air space surrounded by moisture films (magnified).

2.—A. Air space. B. Water film. C. Soil grains with water film (magnified).

conservation and the promotion of free root action. This adverse condition of the soil will persist in undrained land, despite the efforts of the grower by cultivation, &c., to alter it. (See plate 18A.)

Increased and More Regular Moisture Supply.

An erroneous and rather common idea is that drawing off surplus water from the soil is the only benefit of drainage. It does much more than that. In fact, it actually provides more moisture in the summer time, when the trees require it most, for during the warm season undrained land becomes dried out and unable, through its harsh and lumpy condition, to hold moisture like the soil in drained land with its better physical condition. This explains the saying that, "The better the drainage the surer the water supply," a statement opposed to common idea of drainage results. Thus we can claim for well drained land, provided the drainage is accompanied by surface cultivation, a regular moisture supply instead of an oversupply or lack, as the case may be, in undrained land.

It is estimated that where a proper system of drainage exists the soil retains from 10 to 12 per cent. of its weight in water, which is distributed through the soil as films surrounding the particles of soil. These may be considered as minimum amounts in contrast to the maximum amount represented by the complete saturation of soil after heavy rain, or other cause. A glance at plate No. 19 will show how moisture is held in the soil. The films of water surrounding the soil particles naturally vary in thickness, and by their contraction or expansion the air movements in the soil are regulated.

The moisture-holding capacity of the soil is directly increased by proper soil drainage, as will be seen by a reference to plate No. 20. For instance, if the depth of soil above the natural water-table is, say, 12 or 18 inches, and by laying of drains it is increased to 3 or 4 feet, the capacity of the soil for holding moisture is increased accordingly. In fact, such increase is really making an underground moisture reservoir for the use of trees when they are in an active growing condition—the time when they are in most need of it.

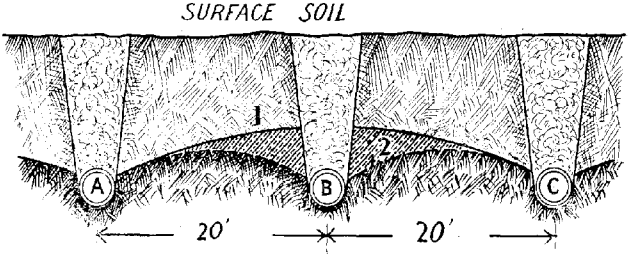


Plate 20.—Showing depth of water-table affected by distance between drains.

A, B, and C.—Drains. 1 and 2.—Water table.

Influence of Drainage upon Soil Temperature.

It is estimated that well-drained land is from 10 deg. to 12 deg. warmer in winter time than land in need of drainage. The colder condition obtaining in the undrained soil is due to the sunlight falling there being employed in evaporating the water, instead of warming the soil, as in the case of well-drained land, where the surplus water passes off through the soil to the drains below.

Soil warmth in winter and early spring is beneficial, as it provides suitable conditions for the activities of nitrate forming organisms, which do not become active till a soil temperature of over 50 deg. is reached. As these bacteria build up the nitrogen content in the soil, the earlier the essential warmth is brought about the sooner will the beneficial activities of these organisms commence producing an enriched soil for the betterment of the trees.

Planning the Drainage System.

Many different factors will need to be considered in the planning of the drainage system of the orchard according to the nature of the site.

For instance, the physical nature of soil and subsoil, the general contour of the land, existing natural water-courses, slopes, whether steep or gradual, and the length of some, will necessarily have a direct bearing on the system to be adopted.

One of the most difficult obstacles to overcome, and one which chiefly presents itself in the level country of some of the northern irrigation districts in Victoria is a proper outlet for the drainage water. In such places, owing to the flat nature of the country, which does not vary for miles around, it is almost impossible to get the water from drains away by natural gravitation. In such places, the sinking of wells as outlets for the drains seems to be the only way to permit it to pass off, and then by means of a windmill or other mechanical means it may be pumped back again on to the land. It is fortunate that the pear tree, in comparison with most of other fruit trees, is better able to withstand excess water lodgment in the soil, especially as these districts are so highly suitable for the production of this fruit generally, and the earlier kinds more particularly. But any means, such as drainage, which provide better growing conditions for the pear, should be adopted, so that maximum results may be obtained.

As, however, much of the fruit-growing land in Victoria highly suitable for pear-growing is situated in undulating country, the problem of draining the land by natural gravitation does not exist, for such places generally offer a ready solution of any minor difficulty which may present itself.

In the plate No. 21, the drainage system of an orchard at Diamond Creek, which the writer supervised, is shown. At first sight, the arrangement will perhaps appear to be rather complex, owing to the comprehensive nature of the scheme. The orchard site referred to in the diagram is composed of a steep slope, gradual slopes, and flats with a fairly large water-course running through the orchard, into which a smaller one empties itself. There are also open-made ditches along the boundary fences on the north and east sides of orchard, which cut off the surface flow of water and seepage from the higher ground above the ditches.

It will be noticed that the drains on the steep slope are run diagonally down the steep hillsides—a course generally advisable under such conditions in order to prevent the silting up of drains. By placing the drains in diagonal rows between the trees, the fall is made more gradual, and the general working of the drains improved. In some cases, the water movement in soil is lateral even on hillsides. This is caused by undulations in the nature of the clay subsoil or some existing hard substratum, the depressions being at right angles to the slope. Where such conditions obtain on hillsides, it is easy to understand how essential is artificial drainage.

By running the drains vertically or obliquely down the hillsides, any existing sluggish lateral water movement will be intercepted, as in the diagram, and, as the case may require, the water flow diverted into its proper direction, and the formation of "pockets" for water prevented.

It will be noticed, by referring to the diagram (plate No. 21), that most of the drains are run through the flats, and open directly into the open water-courses, which should always be adopted, where possible,

care being taken that the outlet pipes are well above the natural level of the water in the channel, as otherwise the silting up of pipes will result, rendering the system inoperative.

The diagonally-shaped flat, as seen adjoining the road in the diagram, is not involved in any of the hill drainage, being cut off by the smaller

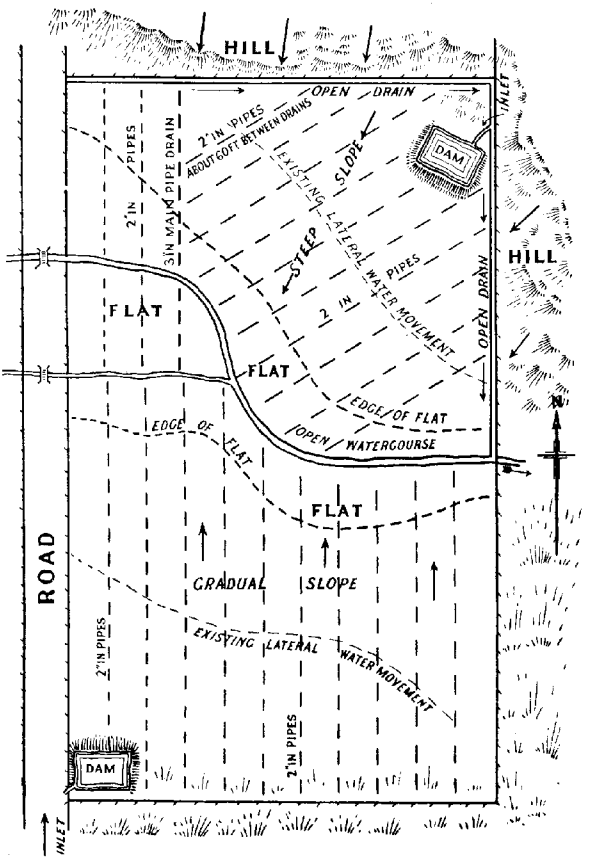


Plate 21.—Plan of an orchard at Diamond Creek.

water-course, and, therefore, it had to be drained separately into the smaller channel towards which it had a natural fall. In the case of the orchard referred to, the planning of a satisfactory drainage system presented no serious difficulty, owing to the existence of a nice clay subsoil, and natural outlets for the drainage water. When, however,

nature has not provided such desirable adjuncts to the work of drainage as natural outlets, it is necessary to provide one or more open ditches following the natural flow of the surface water, and the system will have to be arranged accordingly, running the lateral drains into the open ditches where possible. It sometimes happens that this is not possible, and the open-made ditches or natural water-courses have to be supplemented with main pipe drains, one of which is indicated in the diagram.

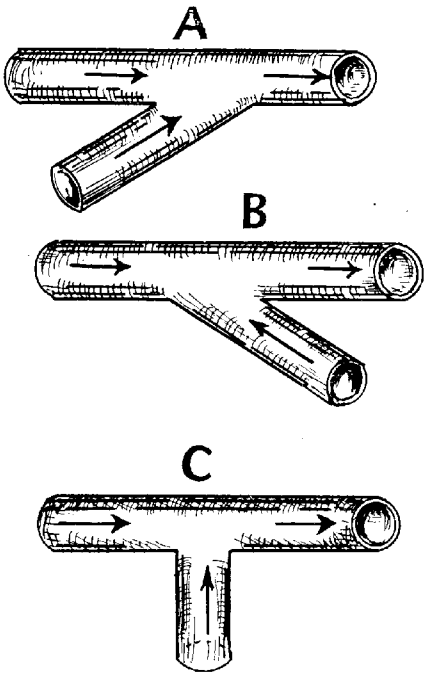


Plate 22.

A. Junction of lateral with main pipe drain (right method). B. Lateral entering main pipe against the flow (wrong method). C. Lateral entering main pipe at right angles (wrong method).

Where the lateral drains are run straight into open water-courses, the junction can be made at direct right-angles, but in the case of main pipe drains being used to receive the drainage from the lateral drains, the junction should be angular and with the flow. In plate No. 22, the right and wrong methods of connecting pipe drains are shown.

Generally, 2-in. tiles will be of sufficient capacity to carry off the drainage water from the lateral system, but where the drains are very long and the area to be drained is large, 3-in. tiles might be used with

advantage. Such conditions will also govern the size of tiles for the main drains, which should be 3-in. or 4-in. as the particular conditions may warrant.

The open ditch is preferable to main pipe drains for carrying off the drainage from the laterals, and when being made, care should be taken to see that the sides of the ditch are sloping. By so doing, the erosion and falling in of the banks will be minimized.

Open drains soon become clogged with *débris,* and should be cleaned out as occasion requires, in order to render them permanently effective.

Depth of and Distance between Drains.

In order to determine the depth and distance apart of the drains, the nature of the soil must necessarily be considered.

Where the soil is of a heavy and compact nature, with a retentive subsoil, it is not, apart from the matter of expense, advisable to place drains too deeply in the soil. If this were done, it is probable that their efficiency would not be as great as if they were at a lesser depth of, say, 2 ft. 6 in., or 3 feet. In soil lighter in character, it is advisable to make the drains another 6 or 12 inches deeper.

The depth at which drains are placed should govern the distance between the drains, as a drain at a depth of 2 ft. 6 in. or 3 feet will not be effective over so great a distance as one placed deeper in the soil. Thus more drains will be needed where the depth is less. In the latter case, the distance apart of the drains, in order to be effective, should be from 20 to 40 feet, and placed midway between the rows of trees, whilst if placed at a depth of 3 ft. 6 in. to 4 feet, in soil of a light character, the drains would probably operate well if at a distance of 60 feet to 80 feet.

Where the drains are placed at lesser distances apart, the water table is deepened in comparison with the table created by drains placed at greater distances. This is illustrated in plate 20. Between the drains A and C, the water-table marked 1 is nearer the surface than at 2, where the water-table has been formed by placing another drain at B, midway between A and C.

Thus it will be seen that underdrains do not create a water-table at the same level over the whole area. At the part where the drain is laid, the water-table is lowered to that level, but is considerably higher mid-way between each drain. Where the rainfall is excessive, it is well to supplement the work of under-drainage with surface drains which, in their own way, do much to relieve the pressure placed upon the underground drainage system; but surface drains alone are insufficient to thoroughly drain the land.

In plate No. 23 is shown an open drain made on a hillside to prevent the surface water and seepage from the higher ground reaching the orchard below. Before this drain was made in an orchard at Diamond Creek, much trouble was experienced with wet conditions in the orchard situated on the lower part of the hill slope, and caused many of the young trees to remain stunted in growth. After the drain was made, however, beneficial results followed at once, and the stunted trees made good growth during the following season.

By looking carefully at the illustration of this drain, it will be seen that stones were placed at the bottom of the ditch to prevent

erosion, which soon took place after the drain was made, thus showing that a considerable amount of surface water, which would have adversely affected the orchard, was carried off by the drain. In all cases where orchards are established on hillsides with higher ground above them, it is advisable to protect them from the surface flow of water and seepage in the manner described.

Within the planted area much good will be done by ploughing up to the trees in autumn, and making a deep furrow down the centre of the rows with the slope, and the beneficial effects of the drainage system enhanced.

Making the Ditch and Laying Tiles.

The work of preparing ditches for drains is sometimes interfered with by the presence of rock, in which case it is impossible to form a

Plate 23.—Open drain on orchard hill side.

satisfactory ditch for the tiles where the rock is near the surface. As such obstruction generally exists only in a small part of the orchard, the best way to deal with it is by blasting, as was suggested when dealing with subsoiling. In this way, a permanent outlet for surplus water is made.

The main expense of drainage work is in the excavation of the ditches. Unfortunately, owing to the exacting nature of the operation, hand work is necessary for the major portion of the work.

When commencing the work of ditch-making, the work can be minimized by ploughing a deep furrow along the drainage line with a single-furrow plough. A Syracuse plough is a handy implement for this purpose, as its construction lends itself to deep work, and with it the soil may be stirred to a depth of 15 inches by repeating the ploughing

after the first furrow has been made. Plate No. 24 shows two of these ploughs at work at Panton Hill stirring the subsoil to the depth mentioned.

By doing the preparatory work in this way, the subsequent spade work is facilitated. For lateral drains, the width of ditch at the surface should be about 15 inches, as no more soil than is necessary should be removed, and it should taper off to about 6 inches at the bottom. For larger drains, it may be necessary to increase the width a few inches as required. It will be found more satisfactory to commence the work of ditching at the outlet, as it will then be easier to determine the proper grade.

As much of the excavation as possible should be done with the spade, and for finishing off the work neatly, as the ditch narrows down, a properly tapered drainage spade and scoop will assist greatly in the perfection of the task, care being taken to make the hollowed-out bed for the tiles as accurate as possible.

Plate 24.—Sub-soiling with Syracuse ploughs at Panton Hill.

When the surface of land is comparatively level it will, in order to obtain an even grade, be necessary to use some means of accurately gauging same, for it is a difficult matter to determine it by sighting alone.

A simple instrument for the purpose, and one easily made, is illustrated in plate No. 25. As will be seen, this grading-board is set to give a fall of $\frac{3}{8}$ inch in 10 feet, or $3\frac{3}{4}$ inches in 100 feet, which is about the grade required to give satisfactory results.

The grading-board should be used as follows:—Place two tiles 10 feet apart over all in the bottom of the excavation, and the grading-board upon them. If the plumb-line shows a dead centre, the grade is correct.

Should it be required to use the grading-board as a level, it may be so used by tacking a piece of wood $\frac{3}{8}$-in. thick on the tapered end of board adjusting the line, and then using it in the ordinary way. After

the tiles are placed closely together at the right grade along the line of drainage, the ditch should be filled in without delay, care being taken not to displace the tiles in any way. The heavier soil should be placed directly upon the tiles, which must be well packed to prevent their shifting from their position, and also to prevent any passage for water being formed outside the tiles.

Other Kinds of Underground Drains.

Although tile drains are, generally speaking, the most satisfactory, good results may also be obtained from drains made of wood and also of stone.

In the case of a wood drain, ordinary stringy-bark (*Eucalyptus macrorrhyncha*), if well matured, will prove durable. An instance of the durability of this wood came under the writer's notice some time ago. When the railway line to Hurstbridge was made, it passed through

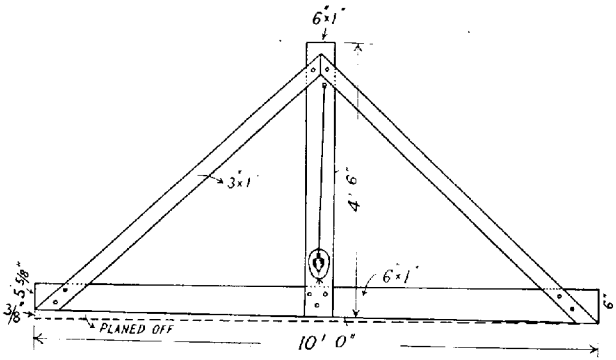


Plate 25.—Grading board, set for grade of ⅜ inch in 10 feet.

Mrs. R. Sharp's orchard at the place mentioned, and in making the excavation for the line, several wood drains were cut through. These were made over twenty years ago, and the wood used in the drains now protruding through the banks of the cutting, is still in a good state of preservation. When obtaining wood for the purpose of draining, trees about 12 or 15 inches in diameter should be selected, cut into lengths of about 6 feet, the bark stripped, and each log split into four pieces.

Three or four layers of these lengths of wood should be placed in the bottom of the ditch, overlapping each other about 18 inches, covered with bark, brushwood, &c., and filled in as in the case of the tile drain. Saplings or immature wood should not be used for the purpose. When stones are used, they should be broken into pieces of about 4 inches in diameter, and a layer of these, about 9 or 12 inches in thickness, placed in the bottom of ditch, and topped with smaller stones.

(To be continued.)

CHICKEN REARING AND POULTRY FEEDING.

A. V. D. Rintoul, Assistant Poultry Expert.

On the majority of poultry farms in this State the task of attending to the chickens for the first eight or ten weeks of their lives is usually handed over to one of the lady members of the household. The hours of work necessary are undoubtedly long, and the results for the following year are largely dependent on the care bestowed upon the chickens in the early stages; yet one rarely hears sufficient praise given for the successful drudgery that is undertaken.

The Brooder.

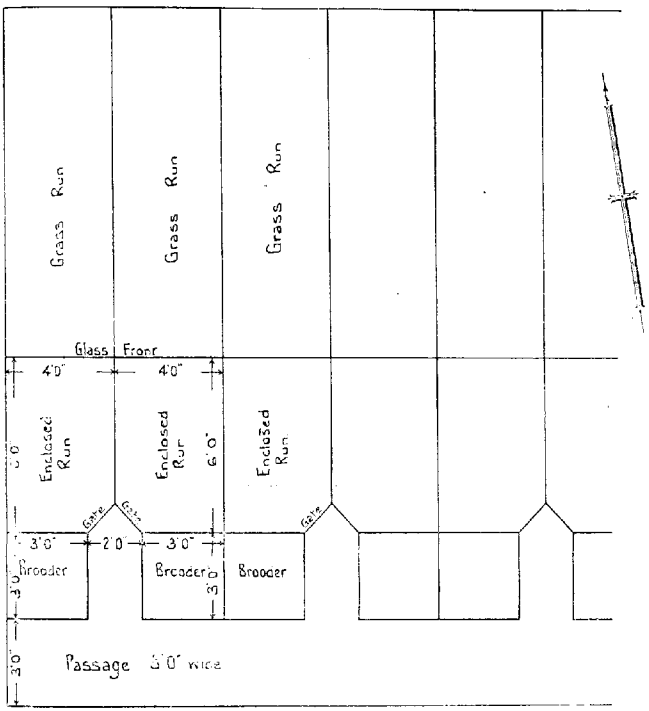
Putting aside the question of hen hatching and rearing as being quite impracticable on a large scale, a brooder of some kind becomes necessary. Those in general use are very varied, the commonest being home-made brooders, some of which are decidedly ingenious. For the poultry farmer in a big way, with large laying flocks, the colony style of brooder, which will accommodate from three to five hundred chicks from the one hatch, is virtually indispensable. The beginner, and the breeder for stud purposes only will, however, be better suited with the smaller style of brooder; should either subsequently desire to launch out on a large scale, colony brooders may be added.

The best size for a brooder box is 3 feet square by 1 foot high. The corners should be angled off, so as to guard against loss in case of crowding during the night. A brooder of the dimensions given will accommodate about 70 chicks for the first few days, which is as many as are likely to be hatched by a 100-egg incubator. Various methods of supplying heat have been used successfully, but the writer prefers electricity when available at "power" rates, viz., 2½d. per unit. The electric connexion is made in the floor of the brooder box, and for the first few days a 16 c.p. globe is screwed on, with an 8-inch flower pot inverted. The hover, with flannel strips, rests on the flower pot. After a few days, an 8-candle globe may be used, and finally a 5-candle globe. Recent experiments with copper resistance wire instead of the electric globe have proved highly satisfactory, and brooders fitted in this manner are now on the market. The cost is very low—about 2d. every 24 hours—the use of a "cut-off" regulator reducing the expenditure. Other brooders are successfully worked by a hot-water pipe system running the length of the brooder shed; others, again, have separate kerosene heaters. Care must be taken at all times that no fumes reach the chickens; pure oxygen plays a very important part in rearing.

The Brooder House.

The brooder house should face north, and to secure as much sun as possible, it is necessary to have plenty of glass in the front. The front is best made 7 ft. 6 in. high, the bottom foot being timbered, the next 5 feet all glass, and the top 18 inches, wire netting, with a hessian blind. This will admit at all times a free circulation of air, but will stop the rain from beating in. The mullions should be of red pine, rabbetted out to take the glass, the bottom pane being put in first, and held in place by small brads. After that the glass is hung by narrow clips as shown in the diagram. This is preferable to using putty, as

with 12-in. x 10-in. or 12-in. x 12-in. glass, with clips, should one pane be broken, it may be more easily replaced than would be the case were the glass set in position by putty. The shed should be 12 feet wide, and about 6 ft. 6 in. high at the back, with skillion roof. The length of the shed will depend upon the number of brooders that are to be used. Allow 4 feet for each brooder, with an indoor run 6 feet by 4 feet, and a 3-ft. passage behind the brooders. The outdoor runs may be 15 or 16



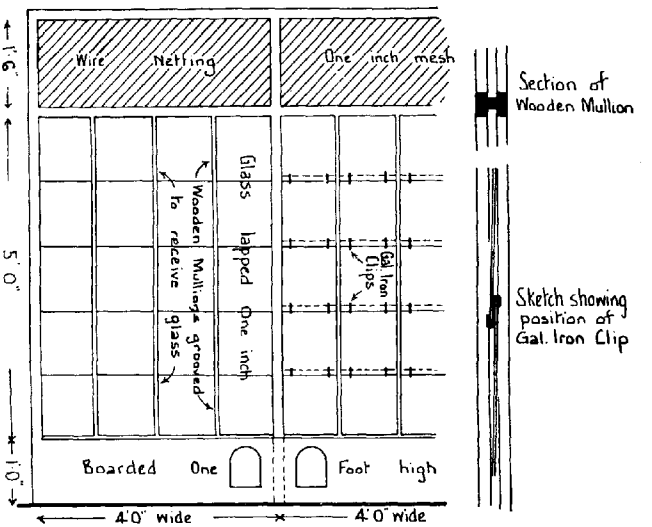
Plan of Brooder House

feet long, and should be sown down in greenstuff each year so as to sweeten the land. It will be noted in the ground plan, on this page, that space is provided between each pair of brooders to enable the feeders to gain easy access to the chickens.

Treatment of the Chickens.

As soon as a considerable number of chickens have hatched out, and are thoroughly dried off, they should be toe-punched or otherwise branded, and removed in a covered receptacle to the brooders, which

should have been previously thoroughly disinfected, and the floor covered with dry sand, oat-hulls, or chaff. Empty egg-shells should be removed from the drawer of the incubator to give every opportunity for the other chicks to hatch. Culling should be practised at once; crippled and weakly chickens should be promptly killed, as the mob will generally thrive better without them.



Front Elevation of Brooder House

FEEDING.

Prior to hatching, the chicks absorb the yolk, which supplies them with their first nourishment, and they should on no account be fed until this yolk has been digested, otherwise indigestion, leading to bowel trouble, is likely to occur. A good plan is to place bagging on the top of the litter, and withhold food until the droppings appear, showing that the chicks are ready for their first food, although water, fine grit, and charcoal may be provided for them when they are first put into the brooder. Where the infertile eggs from incubators are not sold to pastry-cooks they may be boiled hard and mixed with dried bread-crumbs for the first feed, after which rolled oats may be given; but oats are too expensive to use exclusively after the first two days.

As to the relative merits of rearing on either wet or exclusively dry mash, it should be borne in mind that for the first two or three weeks wet-mash feeding is more likely to cause bowel trouble than the dry-mash system, as a crop full of cold sloppy feed is liable to bring on a chill,

which may be followed by indigestion. Where the rearing of table poultry is directly profitable, it would be well to introduce wet-mash feeding after the first three weeks, in order to fully expand the crop, and enable the bird, in consequence, to carry a bigger crop during the "topping-off" process. Many breeders keep bran always available, as it is particularly valuable to young chickens on account of its comparatively high percentage of ash, which assists the development of bone, particularly when supplemented with shell grit and cut bone.

The chickens should be fed every two or three hours. In the case of early chickens, hatched out at a season when it gets dark before five o'clock, it is very necessary to feed them at night by artificial light. One or two breeders already make a point of this, and others would be wise to follow their example. From half-past five in the afternoon until eight the next morning is obviously far too long for any young animal to be without food. The chick feed mixture recommended by Mr. Hart, Chief Poultry Expert, is as follows:—

> After the first week, biscuit meal and hulled oats. After the next fortnight, cracked wheat, 25 parts; hulled oats, 25 parts; broken biscuit, 10 parts; cracked peas (dried), 10 parts; maize, cracked and sieved, 5 parts; charcoal, 5 parts; fine shell grit, 5 parts; and dry bone meal, 5 parts.

For those who do not care about the trouble of mixing, excellent proprietary chick feeds are on the market.

Greenstuff should be chopped up very finely, and fed as freshly cut as possible; on no account should it be allowed to ferment.

Two cardinal points to be observed in poultry rearing are—(*a*) guard against chills, and (*b*) study digestion.

Management.

While a temperature of about 90° Fahr. will be required for the first few days in the brooder, the heat should be reduced some degrees every couple of days, and too much reliance should not be placed on purely thermometric readings. The chickens themselves are the best thermometer. If at all overheated they will spread out evenly as far as possible, and, if cold, will huddle together; the object should be to preserve a happy medium. The death rate is usually in increase ratio to the care bestowed on the chicks, and though at times one hears of from 2 per cent. to 5 per cent. mortality only in some special hatch, on the average throughout the season about 15 per cent. to 20 per cent. may be considered reasonable.

The cost of a pullet from the shell to the laying period is somewhat of a vexed question, and the writer, not long ago, wrote to twenty Victorian breeders asking for their experience in the matter. Fifteen of the twenty were apparently too busy to reply at all, and the other five quoted from 2s. 1d. up to 5s. 6d. There cannot be the slightest doubt that the higher price was more nearly correct. Most breeders will nowadays pay from 2 to 5 guineas for a high-pedigree stud cockerel, and perhaps from 30s. upwards for stud hens. If they have high-class utility stock, the breeding pens should have an average value of £7 or £8 (some breeders have pens worth up to £100). Fifty winter-laying pullets per stud pen would be a fair average, and half the value of the stud pen should be charged against the pullets, say 1s. 6d. each; then, in addition to the

cost of food consumed, there will probably, in the highest breeds, be a loss on the cockerels, besides the hatching expenses, with interest, depreciation, and repairs on the incubator and brooder plant. The profit in egg production on right lines is such that one need not unduly exaggerate, and pretend that pullets can be reared for a couple of shillings, and that every one will show 10s. *nel* profit!

When the chickens are from four to six weeks old they may be removed from the brooder shed to small pens with ample range during the day time, and warmly bedded up with plenty of straw at night. The sexes should be separated as soon as discernable. Continued lack of ample range for the young stock year after year will inevitably result in degeneracy, which, probably unnoticed at first, will sooner or later undermine constitutional vigour. It is all very well to talk glibly of 700 or 800 bird flocks on half an acre, as, while that number of pullets may be housed in their pullet year on a still smaller block of land, the stud pens and the young stock must have ample room, and the continued overcrowding or lack of range must be sternly opposed to prevent the gradual but certain loss of supremacy which our birds at present hold.

POULTRY FEEDING AND FOODSTUFFS.

The six essentials for successful poultry culture are mating, hatching, rearing, feeding, housing, and marketing, and of these probably the most important of all is feeding. A moderate bird skilfully fed would give better results than a highly pedigreed bird indifferently fed. Merely temporary neglect of a sheep or a bullock may not ultimately affect the wool clip or beef, but the slightest neglect of the laying hen results in an immediate decrease in the egg yield, and possibly causes a false moult. Some knowledge is therefore necessary of the constituents of the various foodstuffs and the functions that they perform.

The Nutrient Ratio.

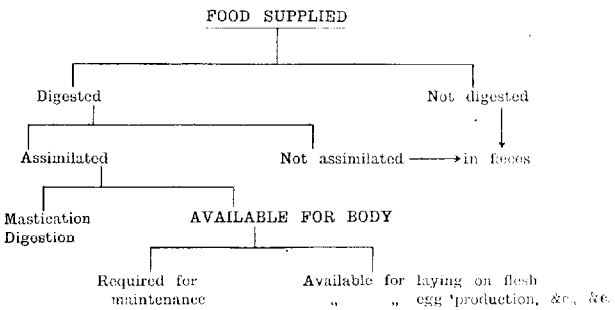
The nutrient ratio is the proportion of digestible nitrogenous matter to the rest of the digestible matter (non-nitrogenous) in any foodstuff. The nitrogenous matter repairs the waste of tissue, and is constructive, in that it builds up flesh, bone, feathers, &c., and is usually referred to as "proteid." The non-nitrogenous matter consists principally of starchy matter, and fats or oils, and helps to maintain the body heat and support respiration, whilst certain oily secretions are derived from the fats and oils which assist lubrication. Fats and oils are two and a quarter times as heating as starchy matter, consequently to arrive at the correct nutrient ratio the percentage of fat is multiplied by $2\frac{1}{4}$ to express it in the same heating terms as that of the starchy matter.

In the case of a foodstuff containing 12 % nitrogenous matter.

		55 % starchy matter.
		$2\frac{1}{4}$ % fatty matter.
the nutrient ratio would be	12	: $(55 + 2\frac{1}{4} \times 2\frac{1}{4})$
	12	: 60 (approximate)
	1	: 5

The Balanced Ration.

The meaning of the term balanced ration is a mixture of foodstuffs which contain sufficient nutrients in the right proportion *for the purpose required.* It is not therefore possible in actual practice to compose a mixture which can be fed in the same proportion all the year round. For one thing climatic conditions will not permit it, and slight modifications are further necessary to render the food continuously appetising. Identically the same food day after day eventually must pall on the most hardened palate. The chart hereunder will show the reader on what uses food taken into the body of a fowl is ultimately expended.



Principal Constituents of Food Materials.

Food constituents may be classified as follows:—

(1) Water, (2) Protein—Nitrogenous substances, (3) "Nitrogen-free" extract or starchy matter, (4) Ether extract—fats and oils, (5) Fibre, (6) Ash.

Functions of water—

(*a*) It supplies firmness and rigidity combined with elasticity to the tissues;

(*b*) Acts as a solvent for the food materials;

(*c*) Carries food materials and waste products.

Protein.

Protein is the accepted name for a class of compounds all of which contain nitrogen, but have varied physical and chemical properties. The percentage of protein in foods is obtained by determining the percentage of nitrogen and multiplying the latter by 6.25, although this factor should be discarded as insufficiently accurate, the factor really varying for different compounds from 5.5 upwards.

Protein is divided into (*a*) Albumenoids, (*b*) Amides. These latter contain nitrogen, but possess properties greatly removed from those bodies recognised as true proteids. They are more abundant in green fodders, roots and tubers than in mature foods.

Vegetable proteids are the sole source of animal proteids. The proteids go to form muscles, connective tissue, skin, feathers, beak, and nails, so may be described as "flesh forming." They may also, however, serve for the production of animal fat, and can be used for the production of energy.

Proteids are used in more ways than any other class of nutrients.

Amides serve simply as a source of heat; although containing nitrogen they do not form tissue. By producing heat they save the proteids, but for this purpose they are of only half the value of the carbo-hydrates proper.

Nitrogen-free Extract.

Nitrogen-free extract is a term including all those substances soluble in dilute hydrochloric acid. It includes (*a*) starches, (*b*) sugars, (*c*) vegetable gums, (*d*) vegetable acids. Carbo-hydrates strictly speaking are substances containing carbon, hydrogen and oxygen, the latter in the proportion to form water. Nitrogen-free extract does not include all the carbo-hydrates found in food; cellulose is not included, being insoluble in dilute hydrochloric acid.

Starch Group.

Starch is found widely distributed in plants as a reserve foodstuff, and exists in grains which are structurally characteristic of the species of plant producing them. It is scarcely found in coarse fodders. The grains are insoluble in cold water, but swell and burst with hot water forming starch paste. Starch is converted by enzymes (diastase and ptyalin) into maltose and dextrine. Acids hydrolise starch to glucose and dextrine.

Sugar Group.

This consists of (*a*) Grape sugar group—glucoses, (*b*) Cane sugar group—saccharoses.

Glucoses—Grape sugar is found in the juice of fruits and in the sap of plants.

Saccharoses—(1) Cane sugar found in sugar cane, grasses, beet-root and mangold.

(2) Malt sugar found in malted barley and germinated grains.

(3) Milk sugar found in milk and whey.

Functions of Carbo-hydrates.

Usually described as the fuel portion of the food, or that portion which goes to the production of energy. They may also be utilized for the formation of animal fat.

Fat—Ether Extract.

This consists of compounds out of finely ground feed stuff dissolved by ether.

The term "fats" or "fats and oils" is technically incorrect as the ether dissolves out free fatty acids, wax, and chlorophyll besides true fats.

The function of fats is to serve as a source of heat and energy as well as a source of animal fat, and as a source of heat are two and a quarter times more valuable than carbo-hydrates.

Fibre.

Fibre is the tougher or woody portion of plants, consisting largely of cellulose. The proportion of fibre digested depends on the part and age of the plant, and also on the animal eating it. Fowls practically digest no fibre. Sometimes more energy is required for its digestion than the fibre itself can supply. The portion digested has the same uses as the carbo-hydrates.

Ash or Mineral Ingredients.

This consists of the residue left when the combustible part is burned off. In plant ash the principal ingredients are lime, phosphoric acid and potash. Maize and the gluten compounds are deficient in lime salts, while bran is comparatively rich in phosphoric acid.

Ash supplies the necessary ingredients for bone formation, and assists in building up the tissues. The predominating salt in bones is lime phosphate, while that in flesh is potassium phosphate. Ash also supplies the essential substances in some of the digestive juices and in the blood.

Composition of Feeding Stuffs.

AVERAGE COMPOSITION AS SHOWN BY ANALYSIS.

Foodstuff.	Water.	Protein.	Oil.	Carbohydrate.	Fibre.	Ash.
	%	%	%	%	%	%
SEEDS AND GRAIN—						
Wheat	10·99	9·89	2·27	73·64	1·87	1·34
Oats	12·15	11·05	4·90	58·95	9·90	3·05
Barley	14·30	12·00	2·40	63·70	5·00	2·60
Maize	13·00	9·90	4·40	69·20	2·20	1·30
Rye	12·21	10·51	1·83	71·34	2·87	1·24
Rice	12·60	6·70	0·40	78·00	1·50	0·80
Millet	12·50	10·60	3·90	61·10	8·10	3·80
Broom Corn	12·70	10·20	3·00	63·60	7·10	3·40
Peas	14·00	22·50	1·60	53·70	5·40	2·80
Soy Beans	10·30	33·20	17·50	30·20	4·10	4·70
Sunflower	7·50	14·20	32·30	14·50	28·10	3·40
GREEN STUFF—						
Lucerne (green)	71·51	5·06	0·88	12·47	7·03	3·05
Lucerne (hay)	12·32	15·56	2·73	38·38	21·64	9·37
Grass Clippings	80·00	3·50	0·80	9·70	4·00	2·00
Rape	85·90	2·80	0·80	5·70	3·50	1·30
Cape Weed	93·16	1·18	0·30	3·14	1·06	1·16
MILL PRODUCTS—						
Wheat Bran	11·33	14·90	4·46	55·41	8·91	4·99
Wheat Pollard	11·20	14·00	4·46	60·90	6·90	2·68
Oat Branning	8·00	9·58	5·37	52·53	19·55	4·97
Oat Meal	8·50	10·10	5·10	60·10	12·60	3·60
Rolled Oats	7·80	16·06	8·20	66·07	1·25	1·62
Hulled Oats	8·20	15·67	7·14	65·67	1·69	1·63
Pea Meal	12·60	23·26	1·54	53·70	6·42	2·40
BY-PRODUCTS—						
Dried Blood	15·00	80·00	0·80	1·50	..	2·70
Bullock's Liver	76·17	5·80	2·50	..	..	1·20
Green Bone	20·46	22·68	11·41	..	..	45·45
Separated Milk	90·30	4·00	0·20	4·70	..	0·80
ROOTS—						
Onions	87·66	1·09	0·25	9·66	0·81	0·53
Mangolds	87·40	1·00	0·10	9·80	0·80	0·90
EGGS	73·67	12·55	12·11	0·55	..	1·12

Poultry Foods and Feeding.

Green Feed.

As green feed forms, or should form, 50 per cent of the birds' diet, it is necessary to maintain a continuous and varied supply. In Victoria it is possible to maintain this supply all the year round, though some difficulty may be found in the northern parts of the State during the hotter summer months. The lucerne plot is of the utmost value, as when ample water and manure are available there is an abundant supply of green feed that can be cut every month all the year round for a period of years. The next most important green feeds are silver beet and chou mouellier, which last a considerable while. In the case of these plants the outer leaves should be pulled off and not cut. Lettuce is excellent for young chickens, but rather expensive to feed largely to adult fowls. Onions chopped up, are an excellent tonic and good for the blood, but if fed to excess would impart a flavour to eggs. Rape is generally sown in the chicken rearing runs and, besides helping to sweeten the soil, is much relished by growing chickens. Suburban poultry keepers generally endeavour to secure the grass cuttings from nearby bowling greens.

Root crops such as turnips or mangolds are greedily eaten by laying fowls and may be fed whole, as the birds will pick all the inside out of a mangold leaving only the rind.

Animal Food.

Meat meal, blood meal, and rabbit meal supply a high proportion of protein in very concentrated form, but considerable care should be exercised in their use, as a constant over supply will over stimulate and so injure the egg organs. In addition there should be sufficient bulk in the food to reasonably distend the digestive organs and so obtain the best results from the digestive juices. These concentrated nitrogenous foodstuffs should be purchased on analysis, as at times a slightly cheaper preparation may contain such a low percentage of protein as to be in reality too dear to use.

"Poultry Wheat."

A mistaken idea seems to prevail (frequently with those who should know better) that much inferior, damaged, or smutty wheat will do for poultry. It will never "do" in the right meaning of the term. Next to seed wheat only the best should be used, the feeding value of indifferent wheat making it dear at almost any price, whilst a light weighing oat merely means buying a high proportion of indigestible husk.

Dry versus Wet Mash.

The question is frequently raised whether the dry mash or wet mash system is the better. Each system has proved highly successful in the official egg laying competitions. In the test for teams of six birds a score of 1,667 was made one year in the wet mash section by Mr. J. H. Gill's team, whilst the following year Mr. W. N. O'Mullane's team in the dry mash section scored 1,699, which is the world's record for a team of six birds. As these scores were made in different years

and by different breeders, it can hardly be claimed that they prove anything conclusive. In single test the 300 mark has been reached in different years by both dry and also wet mash feeding in white leghorns. The official world's record single test 335 by Mr. Graham's black orpington was made on the wet mash system.

Undoubtedly the dry mash system saves an enormous amount of labour, so that even if it were a fact that on a flock average the dry mash system gave a dozen eggs less per bird, it is probable that it would still be quite as profitable, if not more so, than the wet mash. But it has not been proved conclusively that a flock will lay more on wet mash. In the writer's opinion, a hot feed at daybreak during the winter months is conducive to better results. So far as the heavy breeds are concerned, there is with them a tendency to get over-fat on dry mash, particularly with big-framed, strong constitutioned, birds, though less robust birds, lacking spring of rib, have been observed to do well with dry mash.

The practice is to feed as much wet mash as will be eaten up by the birds in a period of about twenty minutes, whereas the dry mash is available all day long. The usual custom in Victoria is to feed grain at night and mash in the morning. There is no necessity for this at all, and a certain amount of time would be saved, and the birds kept far more busy during the day, if the grains were scattered in the litter directly after breakfast, and mash fed at night. To warm the birds up in winter, and take the keen edge off their appetites, about half an ounce of wheat per bird, with an equal amount of water could be put on a slow fire overnight and fed hot at daylight. The wheat should just absorb the water without either burning, or leaving any "soup" over. The birds would then be ready to scratch for the dry grains in the litter between 9 and 10 o'clock in the morning.

The Burnley Mash.

The rations as fed at Burnley for the competitions averaged out as follows:—

Wet Mash.		*Dry Mash.*	
Wheat pollard	1½ parts.	Wheat pollard	1½ parts.
Wheat bran	1½ „	Wheat bran	2 „
Oaten pollard	½ „	Oaten pollard	½ „
Pea meal	¼ „	Pea meal ...	¼ „
Meat meal	⅓ „	Meat meal	¼ „
		Sugar, about	1 per cent.

A very little salt was added to both mashes. It will be seen that the dry mash ration was the same as the wet mash but for the addition of 1 per cent. of dark sugar and a slightly increased amount of bran. The wet mash birds were fairly heavily fed, getting 3 ounces of mash first thing, and about another ounce at midday, with 2 ounces of mixed grain at night, apart from the green feed. Oaten pollard was generally rather difficult to obtain in quantity, otherwise all the other foodstuffs were those in general use.

No stimulants are given to the birds at Burnley, the object being to determine the laying abilities on ordinary foodstuffs, and the overseas experiment of giving the birds "one at eleven" is not likely to find favour in Victoria.

RE-PRUNING OF VINES DAMAGED BY FROST, HAIL, ETC.

F. de Castella, Government Viticulturist.

October is the month during which vines are most liable to damage by spring frosts. The means by which these disastrous visitations can be parried, or, at least, mitigated, are well known. Smudge fires judiciously arranged and well timed have often permitted the saving of a considerable part, and sometimes even of the entire yield. In this connexion frost prediction by means of the wet and dry bulb thermometer is of the greatest value. Warned of the impending danger at sunset the previous evening, all arrangements can be made for the lighting of the smudges between midnight and sunrise.*

The measure of success which can attend such palliative steps depends, of course, on the intensity of the frost. Smoke protection, which would be quite effectual in the case of a fall in temperature to 2 or 3 degrees below freezing point, would be useless against a frost of 9 or 10 degrees below zero.

Vines which suffered owing either to lack of precautions or to the extreme severity of the frost, must receive immediate attention. This is necessary, in the first place, in order to insure healthy and well-developed wood for the following winter's pruning, but also for the additional reason that it is often possible by prompt action to insure a crop in substitution for the one which has been destroyed by frost, and during the same season.

It is not sufficiently recognised that even if the entire crop has been destroyed all is not lost; by means of proper treatment, and especially in the case of a good many varieties of vines, a fair crop may still be relied on.

The buds of the vine are not single, as they usually appear to be. Of course, obviously double and even triple buds are sometimes to be met with; in these two or three large buds are plainly visible. Even where a bud is to all appearances single, however, it is always accompanied by a varying number (from two to four as a rule) of subsidiary buds, which are so small as not to be apparent, even on careful inspection with the naked eye. These latent buds usually fail to develop; in the case of damage to the main bud, however, one or more of them will sprout in its place, the largest, which we may term the secondary bud, forms a shoot similar to that produced by the main bud, which often yields fruit.† These shoots are much more fruitful with some sorts of vines than with others. Though they never equal the primary cane in this respect, they are capable, in the case of some varieties, of producing half or even three-quarter crops. Vines of this type present the precious quality of yielding, subject to proper treatment, a fair crop, even though the first crop may have been completely destroyed by frost.

It is not, however, a question of fruit alone. The wood for the following season's pruning must also be considered, and the frost-

* See *Journal* for September, 1910. A reprint of the article on spring frosts is obtainable on application to the Department.

† The remaining subsidiary buds, which may for convenience be termed tertiary buds, though really of the same order as the secondary buds, are of lesser value. They usually bear no fruit and produce weak canes. Should a recurrence of frost destroy the secondary shoots, they develop in their turn and provide wood of a kind for the following winter's pruning.

damaged vine be so treated as to supply a sufficiency of healthy and fruitful canes. If nothing be done to the vines subsequent to the frost in the way of pruning or disbudding, numerous small shoots will be thrown out by the damaged stubs of the primary canes as well as water shoots from the old wood of the vine. Owing to their number, the individual development of these shoots is very poor, and at the following winter's pruning, not only is there a host of useless canes to remove, but it is difficult to find any sufficiently stout to constitute proper pruning wood.

The accompanying illustrations explain what happens in the more common cases of damage by frost. Fig. 1 shows a spur and portion of the old wood of a short-pruned vine, which was damaged by frost in October, say, ten days or a fortnight before the drawing was executed; the leaves, the embryo bunches (*b, b . . . .*), and the upper portions of the shoots have been completely burnt and blackened by the frost, the whole of the crop as it "showed" prior to the visitation is destroyed. During the ten days following the frost young shoots have sprouted; those marked s, s . . grow from the axils of the destroyed leaves, whilst s_1 s_1 . . are water shoots from the old wood.

If the injured vine be untreated in any way, the spur shown in Fig. 1 will, in the following autumn, after the fall of the leaves, present the appearance shown in Fig. 2, and be little more than a scrubby mass of barren shoots of poor pruning value. If, on the other hand, the damaged shoots be severely pruned by cutting them at A and B, Fig. 1, and care be taken to remove all water shoots s_1 s_1 . . . . (Fig. 1), the result will be vastly different, and the spur will present the appearance shown in Fig. 3. In place of a large quantity of useless wood, there will be two, three, or, perhaps, four stout canes to provide suitable pruning wood, and which have borne fruit, as is shown by the fragments of stalks where the bunches were severed at vintage time. It will be noted that the three canes shown in Fig. 3 are not growths from the frost-damaged shoots, neither are they water shoots; they result from the development of the latent eyes described above, and which would not have developed had the sprouts figured in rudimentary form in Fig. 1 been allowed to remain.

Obviously the most logical treatment for a vine injured as shown in Fig. 1 consists in the complete suppression, as soon as possible after the frost, of all shoots; this must be followed a week or two later by thorough disbudding, all water shoots, which make their appearance in considerable numbers on the old wood, being removed. Careful disbudding is essentially a corollary of re-pruning after frost.

At first it might appear that the sprouts s_1 s_1, Fig. 1, are lateral shoots. This, however, is not the case; they result from the premature development of main buds which, under normal circumstances, would only have sprouted the following spring.* That these normally fruitful buds should produce little if any crop is, no doubt, due to their immature state when forced into growth by abnormal conditions brought about by frost.

Pruning as at C, and even at D, Fig. 1, has often been recommended; it is, in fact, the older method, but it will very generally be found inferior to the more radical treatment at A and B for the reason that it leads to the development of imperfectly matured main buds, which

* See *Revue de Viticulture*, Vol. X., p. 451, 15th October, 1898.

produce little or no fruit, the resulting canes are also less vigorous than those from the older, better matured, and more fruitful latent buds. These canes would, nevertheless, provide suitable wood for the following winter's pruning.

Disbudding or breaking of damaged shoots instead of pruning is often recommended. In many cases the ultimate result is identical; it all depends on the state of development of the frost-damaged shoots. If these are still fairly tender so that, under slight thumb pressure, they break off flush with the spur which bears them, disbudding will give results equal to pruning, than which it is quicker and therefore cheaper. If, however, the shoots have reached such a stage of woody development that breaking off tears the underlying tissues of the spur, damage to the latent eyes may result; in such a case it will be better to employ

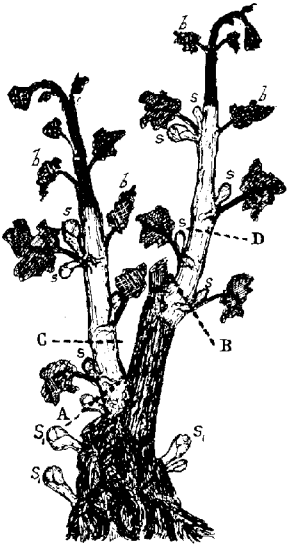


Fig. 1.

Fragment of old wood and spur of a vine damaged by frost early in October. Drawing made a week after the frost. Observe scorched and blackened tips of young shoots, leaves and bunches b, also buds which have sprouted since the frost, s, s are normal buds which should only have sprouted the following spring, s_1 s_1 are water shoots. Treatment consists in radical suppression of damaged shoots at A and B and disbudding of all water shoots.

the secateur, cutting flush with the spur so as to leave no eye of the damaged shoot.

Vines pruned thus often "bleed" profusely, but there is no cause for alarm. The crude sap which is lost is merely soil solution; it only contains about 1½ parts per 1,000 of solid matter, and differs radically from the elaborated sap which makes its appearance later in the season, enriched by the many substances assimilated by, and worked up in, the leaves, which can more aptly be compared to the blood of an animal:

Fig. 1 illustrates the method of re-pruning as practised on short-pruned vines. The treatment recommended, viz.: the radical suppression flush with the cane which bears it of every damaged shoot, applies equally to long-pruned vines, for which it is particularly well suited, for the reason that on the rods characteristic of long pruning the terminal eyes usually sprout first. After the occurrence of frost a good many eyes nearer the base of the rod have not started at all. The radical suppression of the damaged shoots causes many buds which would otherwise not have grown, to send out fruitful shoots, and this in addition to the latent buds described above.

Frost injury does not always occur exactly as shown in Fig. 1. Though this is the most usual form, there may be many variations according to the date and intensity of the visitation, and also to the number of frosts (one or more). A few typical cases may be briefly outlined for each of which some variation in treatment is advisable:—

(i) A frost occurring a good deal earlier—when the vines have just sprouted and the young shoots are an inch or less in length. Though this is, perhaps, the most susceptible period, remedial steps are considerably simplified. A severe frost at this stage destroys all growth so completely that intervention by the vigneron is needless. Sprouting of the latent buds is promoted automatically, and a supplementary or second crop is assured in the case of vines which yield fruit on secondary shoots. New shoots are, however, sent out in excessive number, and careful disbudding is necessary to reduce them and to suppress those which are sterile.

(ii) An early frost of medium severity.—The sprouting buds are damaged, but not altogether destroyed. Close observation is necessary to ascertain the real extent of damage. It must be remembered that shoots partially injured by frost, even though in appearance fairly sound, usually start a spindly, unsatisfactory growth. They seldom result in strong, fruitful canes. Radical suppression of all injured sprouts will generally be found the best policy.

(iii) Frost injury, as illustrated in Fig. 1—the most usual case. Treatment fully described above.

(iv) Injury less severe than (iii)—a certain proportion of the embryo bunches appear to be more or less intact. The best treatment is often puzzling. Such partially-damaged bunches nearly always develop in a disappointing manner, the injury being almost invariably more severe than at first estimated. Treatment as for (iii) is usually best. If, as sometimes happens, a few strong shoots showing fruit are quite undamaged, the rest of the vine being scorched, these shoots may be allowed to remain, but they must be severely stopped so as to divert the sap into the latent buds.

(v) A frost such as (iii), followed by a second frost a week or two later, by which time the latent eyes have sprouted. This is a hopeless case, and little of a remedial nature is possible, since there are no more latent buds from which fruit can be expected; tertiary buds only are available and

they produce poor wood and little or no fruit. Careful disbudding must be practised in order to obtain the best possible pruning wood.

(vi) Severe and very late frost—fortunately such visitations are rare in our climate. If damaged very late in the season (November or December), suppression of shoots is of questionable use, since any fruit produced will be too late to ripen. The best policy is to shorten the damaged cane, or even to confine oneself to disbudding.

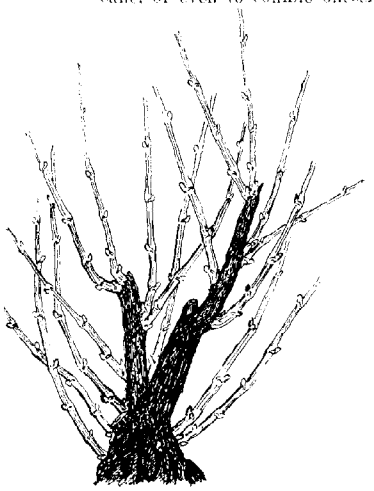


Fig. 2.

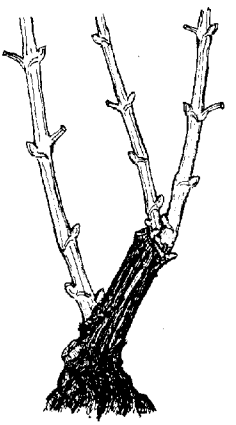


Fig. 3.

Results of re-pruning (or disbudding) of frost-damaged vine.

Fig. 2. shows condition at following winter of portion of vine shown in Fig. 1, if no action were taken after the frost.

Fig 3 shows the result of the suppression of injured shoots (at A and B, Fig. 1) and wood (S_1 S_1). Compare strong fruitful wood of Fig. 3 with poor scrubby growth of Fig. 2.

Subsequent Treatment—Disbudding and Manuring.

In every case, whether the damage be slight or severe, it is very necessary to carefully disbud vines damaged by frost. The water shoots sent out from the old wood need careful removal. It is, in fact, well to disbud twice with an interval of a few weeks between the two operations. The balance of the plant has been upset, and the belated growth of many undesirable shoots often needs correction.

It must be remembered that the vine has to start its season's growth afresh. Normally it begins with ample reserves; for the second start these are necessarily depleted, and the best possible use must be made of what remains. Disbudding must be prompt and thorough, the useless shoots being removed whilst quite small, so as to avoid the waste that would result by breaking them off when they have grown to larger size.

Manuring with quick-acting fertilizers is certainly desirable. It is strongly recommended by French authorities, some of whom go so far

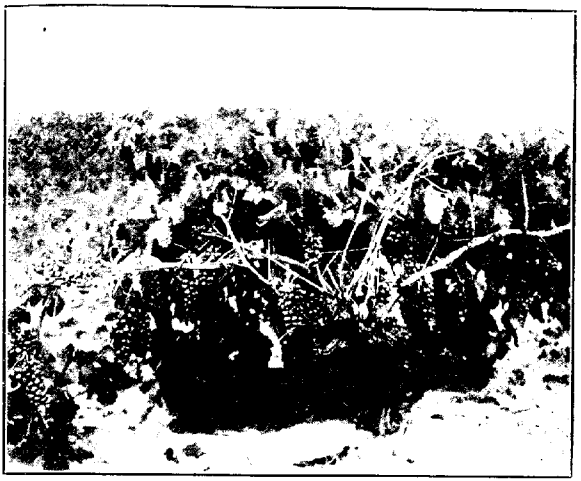


Fig. 4.—Syra or Red Hermitage Vine at Sunbury. Severely damaged by frost on 8th October, 1915, and treated as described in Fig. 1. Result a half crop of grapes and sound pruning wood. Photograph taken 14th April, 1916.

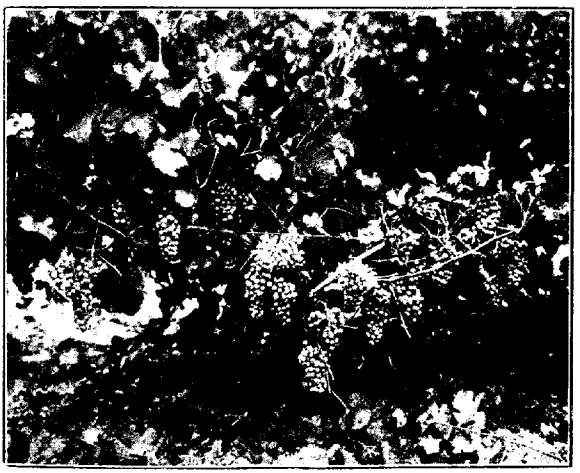


Fig. 5.—Semilon Vine at Sunbury. Conditions as described for Fig. 4. Result, fully three-fourths of a normal yield.

to advise 5 cwt. nitrate of soda per acre. A third of this quantity will usually be found sufficient. The vine has received a severe shock, and this artificial stimulation will help the accumulation of normal reserves for the following season. Such manuring is particularly recommended for irrigated vines. Where natural rainfall has to be relied on the results to be expected scarcely justify the expense unless in a wet spring. In most years the October rainfall is not sufficient for the vines to benefit during the season of application.

A Couple of Examples.

It will suffice to mention two actual cases where prompt treatment on the lines described above gave excellent results.

On the morning of 8th October, 1915, a severe frost destroyed the entire crop of a vineyard situated at Sunbury; all shoots were scorched

Fig. 6. — Mondeuse vine, Viticultural Station, Rutherglen. Frost occurred on 3rd October, 1918. Immediate treatment resulted in yield here shown. Photograph taken 27th February, 1919.

for rather more than half their length. Treatment as described in Fig. 1 was recommended. The vines were not pruned, but radical disbudding was applied, all shoots being completely suppressed. The varieties grown were Syra or Red Hermitage and Semillon; they were trellised and pruned according to the double *Guyot* system (two rods and two spurs). The result was most gratifying; the Syra yielded nearly half a crop, whilst the Semillon did even better, yielding quite two-thirds of a normal vintage. Figs. 4 and 5 are photographs of these vines taken on 14th April, 1916. Being re-pruned so late, and especially in a cool district, such as Sunbury, some doubt was felt concerning the proper ripening of the grapes. Fortunately, the autumn was a fine one, permitting the postponement of vintage until after the

middle of April. These vines ripened their fruit satisfactorily, yielding wines of excellent quality.

Figs. 6, 7, and 8 illustrate vines similarly treated at the Rutherglen Viticultural Station in October, 1918. Three consecutive frosts occurred in the beginning of that month; the first two damaged the vines slightly, while the third was much more severe. On many varieties the whole of the crop then visible was entirely destroyed. Radical disbudding was practised with excellent results, a good supply of healthy wood for the following pruning being obtained. In the case of many varieties the supplementary crop was quite remarkable, as will be seen by the photographs here reproduced. Mondeuse maintained the good reputation it has in France, which makes it the most popular variety in valleys exposed to spring frosts in the Savoy district of France. Even Aramon, although it was one of the sorts which was

Fig. 7. — Touriga vine at Viticultural Station, Rutherglen. Recovery after frost of 3rd October, 1918. Conditions same as those in case of Fig. 6.

most severely damaged, responded well, yielding about half a normal crop.

The following varieties responded remarkably well to repruning, yielding more than half a normal crop:—Groslot, Mondeuse, Corbeau, Aramon Bouschet, Terret Bouschet, Semillon, Cinsaut, Chenin Blanc, and Portugais Bleu.

Recovery was fairly satisfactory with Alicante Bouschet, Calmette, Graciano, Tempranillo, Miguel de Arco, Touriga, and Aramon.

It was rather poor with Gamay, Melon, Aligoté, Joannenc, Terret Bourret, Aspiran Bouschet, Albillo, Joannenc, Carignane, Montils, Piepoul, Colombard, Syra, Cabernet, and Merlot.

It was very poor in the case of Sultana and most table grapes, including Ohanez, Rosaki (Waltham Cross), and Valensi (Belas Blanc), &c. The above refers to the secondary crop of fruit. In every case good pruning wood was obtained.

The damage wrought by hail is often quite similar to that caused by frost, and identical treatment will give equally satisfactory results. This is especially so in the case of a severe hailstorm early in October, such as would destroy all embryo bunches. The crop has gone, but the secondary latent buds are still available, and can be forced into growth by the radical suppression (pruning or disbudding) of the hail-damaged shoots as described above for vines injured by frost.

Hail may fall at any time during the growth of the vine; late hail storms often constitute difficult problems, since radical pruning is no

Fig 8. Recovery after treatment of Alicante Bouschet Vine at Rutherglen Viticultural Station damaged by frost on 3rd October, 1918.

longer suitable. Treatment may usually be limited to trimming and shortening back the injured shoots. Sometimes, indeed, it is best to take no action at all.

After a hail storm it is usually well to defer action for a couple of days until the full extent of the injury can be gauged. The breakages caused by hail are at once apparent, but the bruises show up more slowly; these may be so severe and deep-seated as to justify the removal of shoots which shortly after the storm may seem to have been only slightly damaged.

Vines damaged by flood during the growing season may also present very similar cases to injury by frost and hail, and need treatment on the lines described above. Whenever the fruit and upper portion of the primary shoots has been destroyed the best policy will be their complete removal in order to force the development of latent secondary buds.

FARM NOTES FOR SEPTEMBER, 1919.

STATE RESEARCH FARM, WERRIBEE.

H. C. Wilson, Manager.

The Season.

The season has been anything but a favorable one. September has been a record dry month for the district, and following the particularly dry period of April to August, the grain crops are suffering considerably. Many of the hay crops on fields that were not fallowed in the district are now in head, and very little, if any, hay will be harvested on such areas.

The rainfall for the year to date—

January	.. .. ..	55 points
February	.. .. ..	288 ,,
March	.. .. ..	536 ,,
April	.. .. ..	76 ,,
May	.. .. ..	146 ,,
June	.. .. ..	119 ,,
July	.. .. ..	134 ,,
August	.. .. ..	67 ,,
September	.. .. ..	91 ,,
Total	..	.. 1,512 ,,

A soaking rain is sorely needed to insure even light crops in favoured areas.

Early sown crops on well-worked fallow are comparatively prominent in growth.

Two hundred acres of hay sown on fallow in late April and early May has held out particularly well on the farm, and is now just bursting into head. The yields on these fields will not exceed 1 ton to the acre if heavy rain does not fall within the next few weeks.

Lucerne fields, however, are a smiling feature of the farm this spring, as the early waterings applied in August left their mark and excellent results are now being obtained.

Cultural Operations.

The cultural operations for the month were as follows:—

Fallowing 200 acres (this brings the area now fallowed to 550 acres).

Cultivation and seeding 60 acres field to dwarf Essex rape, 5 lbs. seed per acre and 56 lbs. superphosphate.

Filling, levelling, checking, and grading 100-acre field in preparation for lucerne seeding.

Sowing 10 acres with lucerne (experimental irrigation plots).

Renovation of lucerne fields with heavy "tyne cultivator" and top-dressing with 2 cwt. superphosphate per acre.

Seasonable Activities.

Shearing on September 15th and 16th, 1,000 cross-bred ewes and 100 stud Border Leicester, and Suffolk sheep.

Marketing wool and baled straw.

Tractor demonstrations 18th to 19th September.

Royal Show exhibits, live stock and crop production, 20th to 27th September.

Farmer's Field Day, 26th September.

Chaff-cutting, attention to live-stock and dairy herd, fence renovation, and general farm routine.

Poultry pens and plant still in course of erection.

Irrigation of 240 acres of lucerne and sown grasses.

Plantations attended to, young trees and shrubs replaced where missing.

Seeding of mother sugar beets and general attention to experimental areas.

Fodder Reserves.

The extremely dry season has brought before the flock-owner and herdman the great necessity of storing fodder for emergency, and those producers who have not put by reserves will probably learn a bitter lesson. Attention should now be given where possible to the growth of summer fodders. In this district on the dry areas both rape and Japanese millet do well if given good seeding conditions when sown in the spring.

At the Farm this month 60 acres of early ploughed fallow has been worked up with a disc cultivator and sown with 5 lbs. of dwarf Essex rape and 56 lbs. superphosphate to the acre. This seeding will aid us in carrying the sheep and cattle through the dry months of November to February if the summer rainfall is at all favorable.

Japanese millet sown now at the rate of 12 lbs. per acre with 56 lbs. superphosphate should give excellent results on lighter sandy loams. Of course very heavy yields of maize, sorghums, millets, and Soudan grass can be obtained quickly if offered irrigated conditions.

To those producers, who may intend to adopt the suggestion of spring rape seeding, it may be pointed out that superphosphate has a very destructive influence on germination, if mixed with the seed for any length of time prior to sowing.

Our practice has always been to take the fertilizer and seed separately to the field and mix in correct proportion immediately before sowing through the fertilizer box of the ordinary seed drill. This practice does not interfere to any great extent with the germination powers of rape seed, as the contact is of such short duration.

Even that balance which sometimes may be left in the drill over night should be mixed again in the morning with a fresh supply or germination will be unsatisfactory.

Preparation of Land for Lucerne.

During the past few months a field of 100 acres has been prepared in the following manner for lucerne seeding :—

The land was first ploughed to a depth of 7 inches in September of 1918. Subsequent cultivations during the summer and autumn of 1918 and 1919 were given to insure a fine tilth and the destruction of pest weeds.

The contour plans of the area were first obtained and the directions of the greatest fall were noted.

A drainage channel of 60 chains in length was excavated in July to insure the surface drainage of the area.

Buck scrapers were then used to fill up any crab holes or large depressions that were not shown on the 3-in. contour plan.

The check banks were then marked out 44 feet apart with a single-furrow plough in the direct line of the greatest fall.

Each marked bay was then levelled with the aid of an Austin road grader, and the side fall was reduced consistent with a practical irrigation scheme.

The check banks were then formed to an average height of 5 inches and 2 feet to 2 ft. 6 in. in width by the final operation of the Austin grader.

The surface irrigation channels were constructed at intervals of approximately 8 chains on the nearest and most practical lines of level. The irrigation channels were made with a delver. The average width of the channel should be from 3 feet to 4 feet and 1 foot to 1 ft. 6 in. deep, thus providing sufficient soil to insure strong banks, which are very essential when irrigation of the field is in operation.

The cost of this work on average blocks in the district is as follows :—

	s.	d.
1. Ploughing 7 inches where land is suitable—12s. per acre	12	0
2. Three cultivations, to insure good tilth—3s. per acre	9	0
3. Buck scraping and filling crab holes, &c.—12s. per acre	12	0
4. Setting out checks—1s. per acre	1	0
5. Levelling bays with Austin grader—8s. per acre	8	0
6. Completion of check banks with Austin grader—3s. per acre	3	0
7. Cost of channels—1s. 6d. per acre	1	6
8. Final cultivation prior to seeding—2s. per acre	2	0
Cultivation and grading—Total	48	6

To this can be added—	s.	d.
1. Cost of seed—12 lbs. Hunter River, per acre, at 1s. 4d. per lb.	15	0
2. Manure—1 cwt. per acre, at 5s. per cwt.	5	0
3. Drilling twice over, at 3s. per acre	3	0
Total seeding cost	23	0
Total	£3 11	6

Harvesting Lucerne Hay.

SEEDING LUCERNE ON IRRIGATED AREAS.

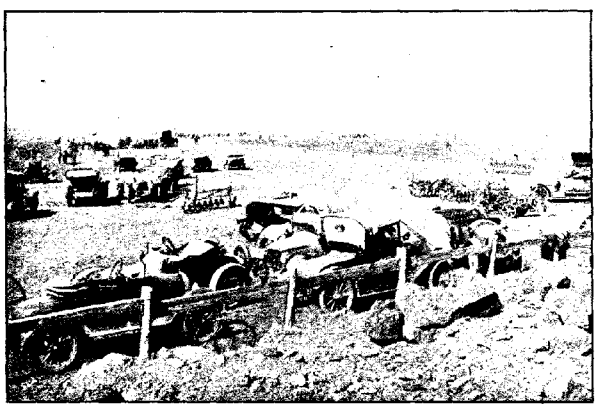
The best months for seeding in this district are September and October, and, if the ground is prepared properly, fine of tilth, firm on surface, and free from weeds, the ordinary farmer's seed drill can be used for the operation.

It has been found through our investigations here that the most suitable fertilizer is superphosphate, and that a seeding of from 12 lbs. to 14 lbs. of Hunter River lucerne per acre gives the best results. This mixture should be sown through the seed-box of the drill, with the discs or tines lifted in such a way that the seed will not be sown to a greater depth than half an inch if possible.

No other cultural operation is necessary except perhaps a very light poppy harrow or brush following the drill.

It has been found sound practice here to divide the manure and the seed mixture per acre evenly, and practise cross drilling so as to insure even distribution, and lessen the consequences of possible errors of judgment by the operator, that is to say, 6 lbs. of seed and also half the quantity of "super." are sown each way at right angles to each other. It is always advisable to trust the natural rainfall to germinate lucerne on these irrigated areas, and not practice irrigation prior to seeding, thus avoiding possible complications which may arise and necessitate laborious cultivation before the most efficient tilth can be secured.

After the young plants are from 2 to 3 inches above ground the first irrigation should be applied again, so as to insure quick stooling of the plant when the ground is apparently firm, and the young lucerne high enough to cut with the mower. The first cut is usually left on the ground, as in nearly all cases it is not heavy enough to gather as hay; however, the second growth should produce from 10 to 15 cwt. of good, clean hay to the acre.



General view of paddock devoted to tractor trials.

TRACTOR DEMONSTRATIONS.

On the 18th and 19th September, tractor demonstrations were carried out on a paddock of the Farm, near the Melbourne-Geelong Railway Line, under the auspices of the Royal Agricultural Society of Victoria.

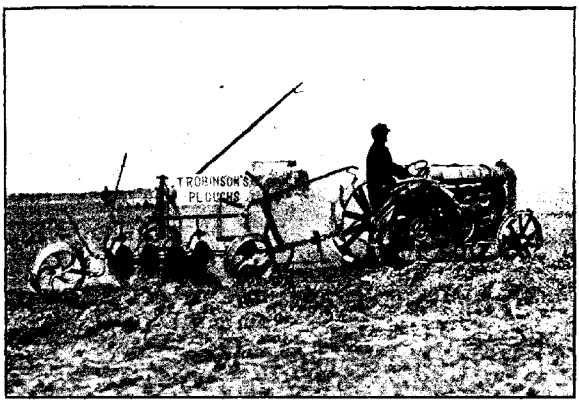
Special trains were run from the city each day of the trials, stopping at the tractor field, and, although the weather was very hot and windy for visitors, a large number of representative farmers were present, and the performances of tractors and horse-drawn implements was followed with great interest. The Trial Tractor Committee decided this year that the display would take the form of a demonstration only, and, therefore, the comparisons drawn were not officially recorded, but were left to the judgment of the visitors themselves. The following tractors and implements were entered for demonstration purposes only.

Sunshine S.F. No. 1 Tractor, H. V. McKay, maker. Drawing four-furrow Sunshine disc plough.

Sunshine S.F. No. 2. Drawing six-furrow disc Sunshine deep cultivator.

Electric Caterpillar Tractor. Pacific Commercial Company. Drawing three-furrow set mouldboard Mitchell plough.

Titan Tractor. International Harvester Company. Drawing four-furrow set mouldboard 90 Series plough.



Crude Oil Tractor. Jelbart's, Ballarat. Drawing 21-furrows Robinson's disc ploughs.

Imperial Tractor. McDonald's. Drawing four-furrow Mitchell disc plough.

Imperial E. A. B. McDonald's. Drawing eighteen-furrows McKay's disc ploughs.

Imperial E. A. B. McDonald's. Drawing one six-furrow McKay's disc plough and one four furrow Mitchell disc plough.

Fordson Oil Tractor. Tarrant's. Motor Proprietary. Drawing four-furrow disc Robinson plough.

Bates' Steel Mule. Clutterbuck Bros. Drawing five-furrow set mould-board Mitchell plough.

Samson Tractor. Ferrier. Drawing four-furrow disc Sunshine plough.

Every tractor when at work was controlled by a steward, with powers to insure a workmanlike job of the ploughing, with an average depth of 4 inches. On both days of the trials 3 acres of land were allotted to the separate entrants, with the exception of Jelbart's Crude Oil Tractor, which took two lands each day.

The visitors showed very keen interest in these demonstrations, and no doubt a step forward in construction has resulted since last year's display.

Live-stock.

Horses. –During the past month the Farm draught horses have been heavily worked on the seasonable cultural operations, and the twenty three-year-old fillies and geldings by the Clydesdale stallion Major Oates, recently broken in, have settled down to work and are developing into big strong animals.

Oaten and wheaten hay form the bulk of their ration, while concentrates, in the form of boiled barley and beet sugar molasses, are given to those which are doing the heaviest of the fallowing work.

Eight foals have already been dropped, by the Clydesdale stallion Baron Wigton, and fifteen more are expected during this month.

Cattle. –Both the Red Polled and Holstein Friesian herds have improved in milk yields, particularly towards the end of the present month, as we have been able to pasture them on the spring crop of lucerne on some of the smaller fields of the farm.

Twenty-one prizes were secured at the Royal Agricultural Society's Show, including Champion and Reserve Champion Red Polled cows, Champion Red Polled bull and Reserve Champion Friesian bull.

Eight calves were dropped during the month.

Silage and chaff reserves are ample for the needs of the dairy herds till the new crops are harvested.

Sheep. –The shearing of the flock ewes, 1,000 head, and 100 stud hoggets was completed on 17th September. The average clip from the whole of these crossbred ewes was 10 lbs.

Twenty-six entries were made in the Border Leicester and Suffolk classes at the Royal Show, 23 prizes being secured, including First and Champion for Border Leicester Ewe; First for Border Leicester two-tooth Ram; First and Champion for Suffolk Ewe; and First and Reserve Champion for Suffolk Ewe.

350 Suffolk cross lambs have been marketed during the past month at an average price of £1 1s. per head; 80 aged cross-bred ewes brought 28s. 6d. per head at auction, and 300 lambs are still on the farm awaiting trucking accommodation. To date 160 per cent. of lambs have been marked from our Suffolk stud and 130 per cent. from our Border Leicester stud.

Poultry.—Further progess has been made in the direction of the new poultry plant at the farm, to accommodate the fowls recently transferred from the Wyuna State Farm.

2,000 eggs per week are being gathered from 530 pullets and hens, while 1,000 chicks are now in the brooders and chicken houses.

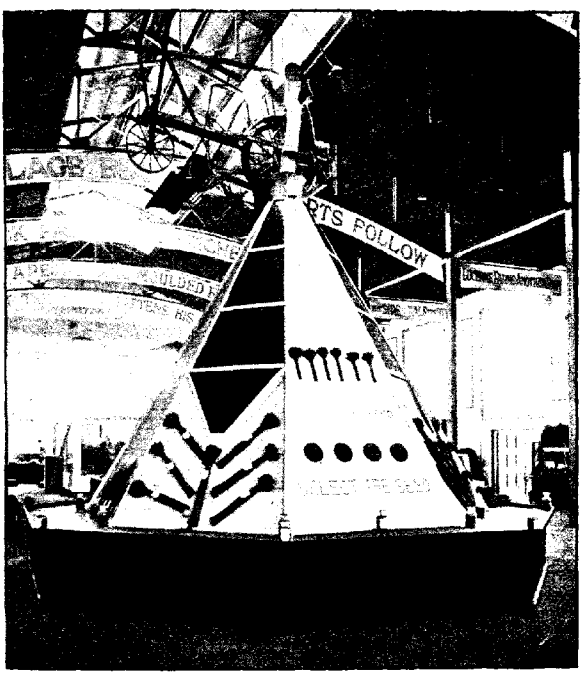
Returned Soldiers.

Nineteen returned soldiers were in residence during the month undergoing a course of training for the Qualification Certificate.

Experimental Areas.

Crops.

Most of the remarks made under this heading last month still hold good and the prospect of a good harvest has not improved. Early varieties of wheat, and even late varieties, such as Warden, where sown early, are now



Interior of Departmental Pavilion, Royal Agricultural Society's Show Grounds, showing central pyramid devoted to wheat exhibits.

in head; Algerian Oats are also heading with a short growth. The dry season has necessitated irrigating the stud cereal plots in order to give the large number of standard and crossbred cereals a chance to develop. Lucerne is making a very fair growth, especially on sections which were renovated, top-dressed with super, and irrigated early in the season. The Rape, Barley and Oat plots in the green manurial rotation field have made a fair growth since the first "feed" (particulars of which were given last month) was obtained. They have been stocked with sheep and the second "feed" is

now in progress. The crops on the three companion plots of rape, barley and oats in the "ploughed-in" section have been turned under.

Lucerne Experiments.

A field of ten acres has been set aside as a permanent irrigation field. This was prepared by ploughing, subsoiling, cultivation and grading, and during September was sown with lucerne in experimental plots, comprising new sets of variety, fertilizer and topdressing tests, as well as others, to determine:

1. The influence of varying applications of water on lucerne yields.
2. The influence of fertilizers on water requirements of lucerne.
3. The best time to cut lucerne.
4. The best method of renovating lucerne.
5. The factors relating to production of lucerne seed.

Royal Agricultural Show Exhibit.

For the first time since the Farm was established, an exhibit was sent to the Departmental pavilion at the recent Royal Agricultural Show. It was designed to illustrate, as far as possible in a graphical manner, a few of the results from the experimental yields and was in three sections, as follows:—

1. *Lucerne*, showing—
   - (*a*) Moisture requirements.
   - (*b*) Results from topdressing tests for four years.
   - (*c*) Phosphate requirements.
   - (*d*) Food value of leaves and stems.
   - (*e*) Root development.
   - (*f*) One year's growth of lucerne crop.
2. *Hay Rotations*, showing—
   - (*a*) Growth of crop for past four years under four rotation systems.
   - (*b*) Samples from green crop now growing same plots.
3. *Plant Breeding*, showing—
   - (*a*) Advantages of hybridization and selection.
   - (*b*) Enlarged models of wheat, rye, and oat flowers.
   - (*c*) Increased yields from the new crossbred wheats "Gallipoli" and "Graham."
   - (*d*) Improved types of flax for fibre and seed.
   - (*e*) Crossbred barleys, showing an example of Mendelism.

FARMERS' FIELD DAY AT WERRIBEE.

The annual farmers' field day at the Werribee Research Farm was held on the 26th September, when about four hundred farmers accepted the invitation to visit the Farm. The visitors were met at the Farm gate by the Minister of Agriculture (Hon. D. S. Oman, M.L.A.), and welcomed on behalf of the Government. Mr. Richardson (Agricultural Superintendent), in welcoming the guests in the name of the Department of Agriculture, said that though the Farm had been established wholly for purposes of investigation and research, yet after last year's working expenses, interest on capital, and depreciation charges had been met an amount of over £90 was paid to the Consolidated Revenue. This result, Mr. Richardson said, was in a very large measure due to the excellent management of Mr. Wilson, the Farm Manager.

After the visitors had viewed the Red Poll herd, which was grazing in one of the lucerne fields, they were piloted over the experimental plots by Mr. Richardson. The objects of the field experiments include the determination of the most suitable type of crop rotation for districts with a light rainfall, the types and quantities of fertilizers necessary to give the maximum net profit per acre and the cultural practices most suitable for the profitable growth of cereal crops. Experiments are being conducted to determine the quantities of water required for various irrigated crops, and continuous efforts are being directed to the improvement of cereal crops by selection and hybridization. Upwards of 1,000 new crossbred cereals, in stages of development from the first to the sixth generation, are undergoing trial. The latter crossbreds are being grown in rows alongside standard wheats like Federation and Yandilla King, and if the comparison be favourable the new wheats will be tried on a large scale alongside the best local varieties.

Border Leicester Sheep, Werribee Research Farm.

The irrigated lucerne fields were of great interest to everyone, particularly the farmers from the Mallee and the North-East. In the course of a brief lecture Mr. Richardson said that though as much as 6½ tons per acre had been cut in favourable seasons, it was not known whether this was the best yield that could be looked for, as no exact experiments have been conducted to show the most favourable quantity of water for lucerne yields, the influence of varying quantities of water, nor the best method of applying irrigation. A new field of 10 acres has been set apart for the investigation of these and similar problems, and special water-measuring devices are being installed to accurately measure the quantities of water applied to each plot. A visit was made to one of the lucerne paddocks which was undergoing watering, and later a 50-acre paddock was seen where renovation work was in progress. Surprise was expressed that the cross-cultivation to which the field was being subjected would not permanently damage the stand, but the healthy growth

in other paddocks, which had undergone like treatment, showed how baseless was this fear.

After a glance was had of the field where beet seed is being raised for use at Maffra, the area devoted to the cultivation of flax was visited. On the 36 flax plots experiments are being made to test the influence of fertilizers, the rate of seeding, the time of sowing, and the effect of irrigation on flax when grown for fibre and seed purposes.

Farmers viewing herd of Red Poll cattle grazing on lucerne.

Top-dressing lucerne with 2 cwt. of phosphates, Farmers' Field Day, Werribee.

The permanent fertilizer plots told their own story, and the green manurial area was the scene and theme of a lecturette by Mr. Richardson, in the course of which he made the interesting statement that in the first grazing from Algerian oats this year a return of £2 per acre was obtained.

The Border Leicester and Suffolk flocks were inspected during the afternoon's tramp round, and on the return of the party from the field a number of people took advantage of the fact that the Red Poll and Friesian cows were in the bails to get a close view of them.

During the afternoon the visitors were entertained at afternoon tea, and at its conclusion Mr. W. H. Everard, M.L.A., moved a vote of thanks to the Minister of Agriculture. He said that he had expected to see more people present, but that the Farmers' Conference had probably kept a great many away.

The Hon. W. Hutchinson, M.L.A. (Minister for Education), in seconding the motion, said:—"On two occasions I had, as Minister for Agriculture, the pleasure of welcoming visitors to the Research Farm on field day, and I well remember the first day, after a drought year, when the members of the British Association for the Advancement of Science were here. Dr. Hall, who had been associated with perhaps the greatest Experiment Station in the Empire—the Rothamstead Experiment Station—said, after a tour round this place under the guidance of Mr. Richardson, that there was no Farm of its character that he had visited which had made such development in the time that had elapsed since its inception, and no Farm where the farmer could learn so many practical lessons that would be of benefit to him. I have made a practice of coming here every year that I possibly could, and I am pleased to find there are a number of farmers who come year after year. I am very pleased to note the remarkable growth and development of the Farm, and I was delighted to hear Mr. Richardson's statement at the gate as regards finance. When the Government established the Farm, they knew, and they told the community, that it would cost money, but they felt that the money expended would be worth while, because of the value to the farmers of the lessons it could give. It was anticipated, and on an average the work of this Farm has cost the community about £1,500 a year, and that amount is a splendid investment for the farming community and for the State, because here experiments are made which the ordinary farmer could not afford to carry out at his own expense, and which the State has no right to ask him to carry out. The State undertakes this experimental work at a cost of about £1,500 a year, but, for the second time in the records of the Farm, last year ended with, not only all working expenses, interest, and depreciation met, but also with a small balance to be paid into the Consolidated Revenue. This result is a magnificent tribute to the Department over which Mr. Oman presides. It is a great tribute to the enthusiasm and energy of the Director of Agriculture (Dr. Cameron), and to the organizing and instructive work of the Superintendent of Agriculture (Mr. Richardson) and, perhaps above all, to Mr. Wilson, the manager of the Farm, and the staff that has supported him."

In acknowledging the vote of thanks, the Minister of Agriculture (Hon. D. S. Oman, M.L.A.), said:—"I am very pleased indeed to be present here to-day. I can assure you that since I have undertaken the charge of this Department I have made your interests my own, and I have been ably supported by my staff. I am fortunate indeed in the fact that I have a loyal staff, who make the public interest theirs, and who render excellent service. I am sure we have all been interested in what we have seen to-day, and we all hope that this Farm will continue to show the satisfactory results that have been achieved during the last year or two, and at the same time will demonstrate to the public what an Experimental Farm can do and does do. I thank you all for your attendance here to-day."

DISEASES OF PLANTS NEW TO VICTORIA.

By C. C. Brittlebank, Vegetable Pathologist.

I. Anthracnose of Lettuce.

Didymaria perforans (Ell. et Ev.) Dand.

Syn. Marssonia perforans (Ell. Ev.)

This destructive disease was first found on cultivated lettuce (*Lactuca sativa*) and was recognised as a new disease by Prof. A. D. Selby, who directed attention to it in Bulletin No. 73 of the Ohio (U.S.A.) Agricultural Experiment Station. The name, *Marssonia perforans*, was proposed by Dr. J. B. Ellis, to whom specimens had been sent by Prof.

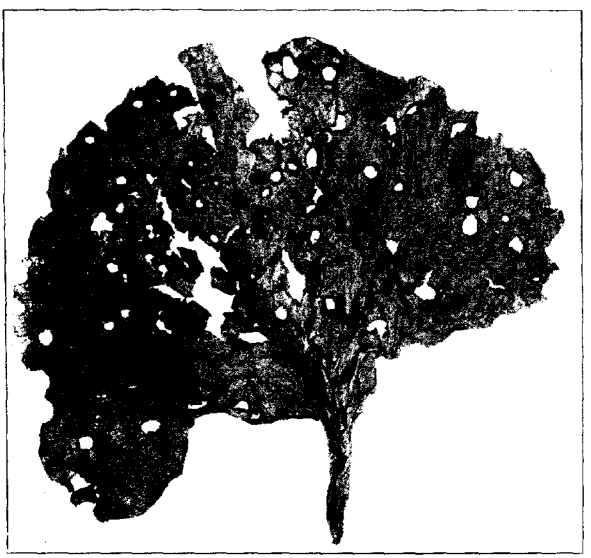


Plate 1.—Lettuce leaf showing injury caused by M. perforans (Ell. et ev.) Dand.

Selby. The following is the description of the fungus and the appearance of the affected plants given by the discoverer:—"Spots, small, irregular in shape, 1-2 mm. in diameter, pale, soon deciduous. Acervula 100-120 μ. in diameter, or by confluence longer. Conidia abundant clavate, or wedge shaped. Hyaline faintly uniseptate 11-15 by 2½-3 μ. Exceptionally reaching 20 μ long." The history of the entry of this disease into Australia is like that of several other plant diseases, and clearly shows the danger attached to the unrestricted importation of seed from various parts of the world where certain diseases are known to exist. Owing to the war conditions lettuce seed could not be obtained from the usual source, and consequently supplies were obtained from a

certain centre in the United States of America. Part of one of these consignments was sold to, and planted by the owner of a market garden in a Melbourne suburb, and it was from this garden that lettuce leaves affected with the disease were obtained by Mr. Chas. French, jun., Government Entomologist

There is no doubt as to the source from which the disease was brought here, as plants were raised in the garden from other seed, but only those from the American seed were affected. Acting upon the advice of officers of the Department of Agriculture the diseased plants were destroyed, and up to the present no fresh outbreak of the disease has been reported.

CONTROL.

The disease first appears upon lettuce in the form of numerous light brown or yellowish-brown spots more or less circular, but often so numerous as to become confluent. The diseased portion dries, becomes brittle and falls away, leaving the outer and a great number of the inner leaves perforated. To persons unacquainted with lettuce anthracnose the injury might be thought the result of attacks by insects. Experiments show that spraying with Bordeaux mixture 6.4.80 will hold the disease in check. Diseased plants should be removed and destroyed by fire, and not thrown on the headlands or rubbish heap.

II. Botrytis and Sclerotinia Diseases of the Passion Vine.

(*a*) *Botrytis cinerea* (Bon) War.

In the spring of 1916 numerous passion fruit vines were reported to be affected with a serious disease. An examination revealed the fact that they were affected with *Botrytis cinerea*, and another disease caused by a species of Sclerotinia. Cultural methods showed them to be distinct, but the symptoms of attack were similar, *i.e.*, from the general appearance as exhibited on the vines.

In the Botrytis it was noticed that the chief point of infection was where the vine was tied to the trellis wire. At these points the vine is often slightly injured by friction, and these slight wounds offer a ready opening for the fungus. The symptoms of attack in the case of passion vines is similar to that in the case of other plants attacked by Botrytis. The death of the plant cells is in advance of the fungus hyphæ. Wilting and death of the vine beyond the infection point is rapid, and after death sclerotia are formed beneath the loose bark and in the pith of the vine. In the latter case, if the vine be split it will be found that the pith for several inches has been replaced by a slender cylindrical sclerotium, in appearance resembling the lead in an ordinary pencil. In the cultural experiments made, conidia were obtained from the sclerotia found internally and externally. These were placed on the young tender shoots, and also at the collar of the vine, but no infection took place. (Plate 2, Fig. 1.)

A similar experiment was again carried out after slight punctures had been made with a sterile needle, and infection resulted. (Plate 2, Fig. 2.) Plants infected by conidia from culture on 14th November wilted on the 18th and died on the 21st of the same month. Another set of experiments was carried out with the mycelium only. In this test, mycelium was placed at the collar and on the young shoots, and covered with damp cotton wool and oiled paper. No infection took place. Later, the experiments were repeated on plants that had been wounded with a very fine sterile needle and infection followed, the mycelium, like the

conidia, being able to gain entrance only through wounded tissue. (Plate 2, Fig. 3.)

(*b*) *Sclerotinia sp.*

In its action the disease produced by this fungus is similar in appearance, and might at first be easily mistaken for that caused by Botrytis. In culture the sclerotia failed to produce ascophores. As

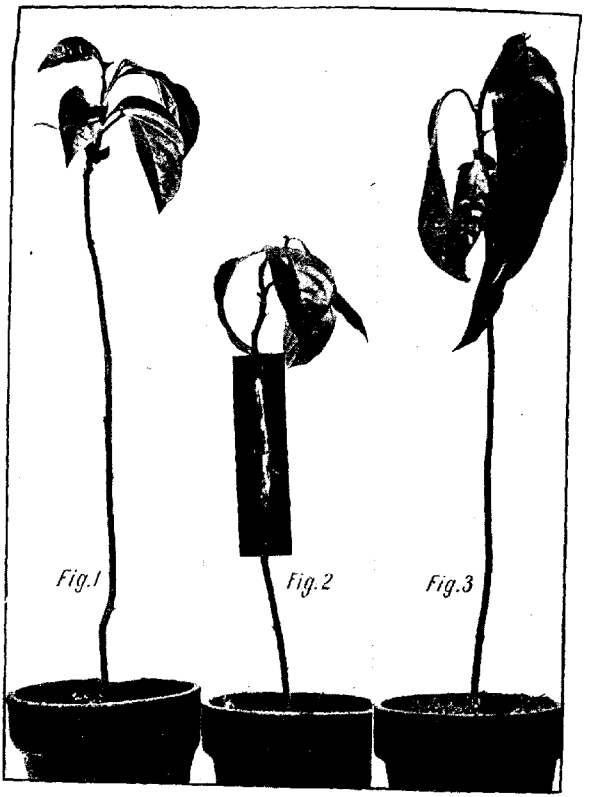


Plate 2.

with Botrytis, the mycelium when brought into contact with the vines was unable to enter through sound tissue, but caused rapid injury and death when in contact with injured plants. It was noticed that the general point of attack was at the ground level or slightly below it, or at the point where injuries are more likely to occur during cultural work. Sometimes, though not often, the disease was observed at the forking of the vine close to the ground.

Control.

Both Botrytis and Sclerotinia have been largely held in check in gardens where their presence has been noticed, by cutting away and burning the diseased portions of the vine, followed by several sprayings of copper soda spray of 6.9.40 strength.

FARM GATES.

By W. Adams, Building Instructor, Dookie Agricultural College.

Of the numerous styles of gates, those made in the manner set out hereunder are most suitable for use on the farm.

Good gates of a uniform pattern improve the appearance of the farm. A light gate, well made and braced, is superior to a very heavy one, being easier to open and less likely to get out of order.

Single field gates are better than double gates, especially where cultivation is carried on; they are easy to open, and require less attention where horses are being handled.

If gates of a standard size are used, a supply of spare parts can be made on wet days and off time, and thus any damaged parts may be replaced very quickly.

Gates should be made at least 12 feet wide, to allow implements and machines plenty of room to pass through.

No. 1 Design.

This gate is 12 feet wide and 3 ft. 9 in. high. It is made with mortice and tenon joints, and fastened with bolts and nuts, and is easy to take to pieces for repair in case of breakages.

All mortice and tenons are painted before fixing, and all braces and pickets are painted on the inside before the gate is finally put together. The painting will help to preserve the wood.

This style of gate is hung with a 3-in. eye-bolt on the top and a block of wood let into the ground on the bottom.

Materials required—

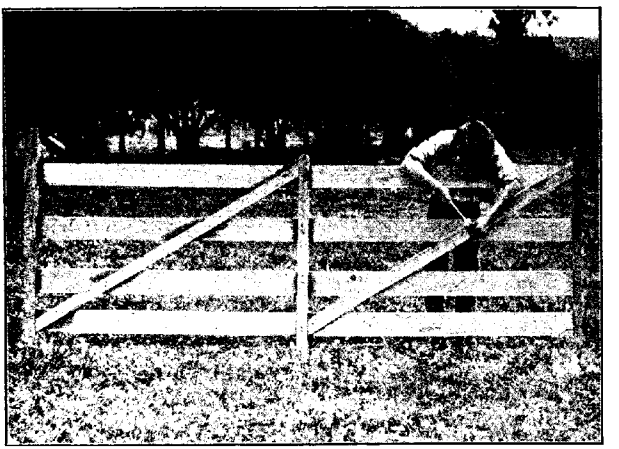
Rails, four 12-ft., 6 in. x 1 in., Hardwood	...	Total, 40 feet super, at 17s. per 100 feet (at mills)
Hanging head, one 5-ft., 4 in. x 3 in., Hardwood	...	
Closing head, one 4-ft., 3 in. x 2 in., Hardwood	...	
Pickets in centre, two 4-ft., 3 in. x 1 in., Hardwood	...	
Braces, four 7-ft., 3 in. x 1 in., Hardwood	...	
Bolts and nuts, eighteen 3½ in. x ⅜ in.		
Eye-bolt, one 3-in.		

The bottom rail is 3 inches from the ground, and the other spaces are 4 inches, 7 inches, and 7½ inches respectively.

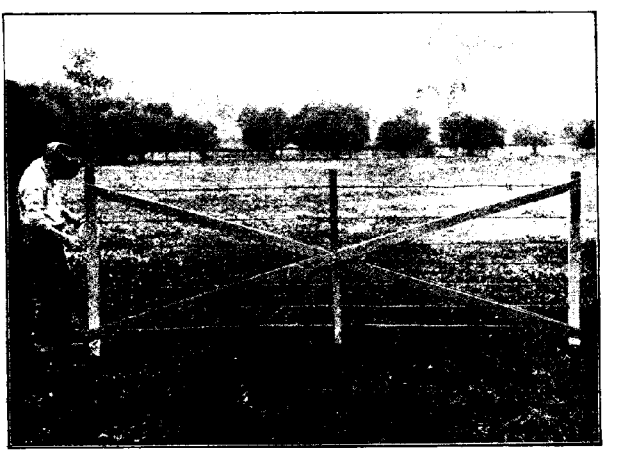
The size of mortice may be set down as from ⅓ to ½ of the width of head, and the tenon must not be more than four times its own thickness.

No. 2 Design.

This gate is of a novel design, having no wooden rails as in No. 1. It is suitable for a paddock with a wire fence, and is made with the same number of wires as is in the fence.

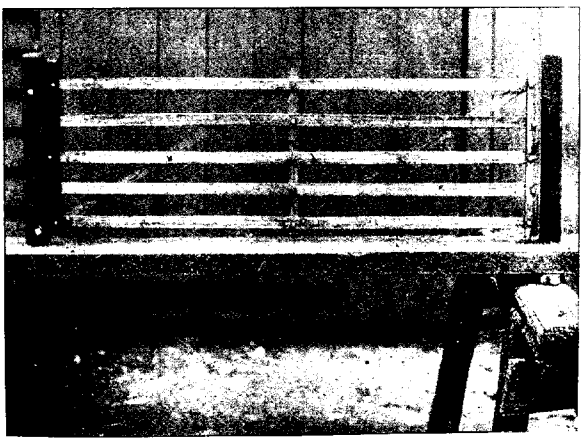


No. 1 Design.



No. 2 Design.

No. 3 Design.



No. 4 Design.

The frame is fixed together by bolting the braces on to the two heads as shown in the illustration. Each end of the brace is cut with a shoulder let in half-an-inch to take the strain off the bolts; the centre upright is then put in between the braces, thus giving them a spread.

The length of the wire should be as short as possible, and the thread of the bolts should come through the heads just far enough to permit the nut being screwed on. They could be all fastened on to the eye-bolt before putting the eye-bolt into the frame; then, by screwing up the nuts at the same time, the gate is ready for use, and the wires may be tightened at any time when slack.

Materials required—

Hanging head, one 5-ft., 3 in. x 3 in., Hardwood ... } Total, 29 feet
Closing head, one 4-ft., 3 in. x 3 in., Hardwood ... } super., at 17s.
Centre upright, one 4-ft., 3 in. x 2 in., Hardwood ... } per 100 feet
Angle braces, four 13-ft., 3 in. x 1½ in., Hardwood ... } (at mills)
Bolts and nuts, four 5½-in., one 10-in. x ⅜-in.
Eye-bolts, fourteen 6-in. x ¼-in. for the wires, one 3-in. for gatehead.

The bottom wire is 4 inches from the ground, and the next four are 5½ inches apart, the sixth 7 inches from the fifth wire, and the top wire, which is barbed, 9 inches from the sixth.

Paint underneath wherever the pieces of wood touch each other.

No. 3 Design.

This gate is a five-rail gate, made of battens. The rails are morticed into the hanging head, and the two pickets are bolted together to form the closing head, with the centre picket and braces bolted on one side only.

The bottom rail is 3 inches from the ground, and the spaces between the rails are 4½ inches, 5½ inches, 7 inches, and 10 inches.

Materials required—

Rails, five 12-ft., 3 in. x 1 in., Hardwood ... } Total, 25½ feet
Hanging head, one 5-ft., 3 in. x 3 in., Hardwood ... } super., at 17s.
Closing head, two 4-ft., 3 in. x 1 in., Hardwood ... } per 100 feet
Centre picket, one 4-ft., 3 in. x 1 in., Hardwood ... } (at mills)
Braces, two 7-ft., 3 in. x 1 in., Hardwood ... ... }
Bolts and nuts, twenty-two 3-in. x ⅜-in.

No. 4 Design.

This gate is a good serviceable gate. It is easily made, having no mortice and tenon joints, and may be put together with bolts and nuts.

It consists of five rails of 5-in. x 1-in. hardwood. To form the hanging and closing heads, two pieces of 4-in. x 1-in. hardwood are bolted together, and in a similar manner the two centre pickets, with the braces of 3-in. x 1-in. bolted on.

Material required—

Rails, five 12-ft., 5 in. x 1 in., Hardwood ... ... } Total, 40 feet
Heads, four 4-ft., 4 in. x 1 in., Hardwood ... ... } super., at 17s.
Pickets, two 4-ft., 4 in. x 1 in., Hardwood ... ... } per 100 feet
Braces, four 7-ft., 3 in. x 1 in. Hardwood ... ... } (at mills)
Bolts and nuts, twenty-five 3½-in. x $\frac{5}{16}$ in.

The tools required to make this gate are a saw, a square, a brace and bit, and a spanner.

SILAGE IN RELATION TO ACIDITY IN MILK.

(*L. M. McNab, B. Ag. Sc.*)

Whether silage has an effect in causing milk to "sour" quickly has been a debatable point amongst dairy farmers for some time, and in many cases silage is blamed when the increased acidity reported by the factory is perhaps due to improper care and handling of the milk.

With the idea of clearing up any misconception, the following tests were carried out at Werribee Research Farm on eight Friesian cows.

For the first week they were fed on rations containing 9 lbs. of silage per day; the second week this was increased to 18 lbs.; and during the third week the rations contained no silage at all.

The acidity tests were carried out within a quarter of an hour of milking, and, therefore, before any development of lactic organisms could affect the acidity figure.

The following results were compiled from over 100 examinations of morning and evening milk and are reckoned in terms of the number of cubic centimeters of decinormal ($\frac{N}{10}$) caustic soda solution necessary to neutralize the acidity of 100 cubic centimeters of milk, using phenol-pthalein as an indicator.

The tests were carried out during the last three weeks in August, 1919:—

Cow.	Average 1st week.	Average 2nd week.	Average 3rd week.	Average for 3 weeks.	Remarks
	9 lbs. silage.	18 lbs. silage.	No silage.		
	c.cs.	c.cs.	c.cs.	c.cs.	
No. 1	21·4	21·3	22·2	21·6	
No. 2	19·6	17·5	18·5	18·5	Near end of lactation
No. 3	22·2	21·7	21·7	21·9	
No. 4	20·7	19·5	20·6	20·3	
No. 5	21·4	20·5	20·9	20·9	
No. 6	21·2	21·3	21·7	21·4	
No. 7	21·1	21·2	19·9	20·7	Check cow
No. 8	19·9	20·6	21·2	20·6	
Average Herd	20.9	20·4	20·8	20·75	

Cow No. 7 received no silage during the second week, and 18 lbs. during the third week, to act as a check on the rest of the herd.

It will be noticed that when the cows were fed on silage, the average for the herd was ·4 c.cs. lower than when fed without silage, instead of showing the increased acidity expected. The difference is so slight that it need not be taken into account, since individual cows varied 3·4 c.cs between the highest acidity and lowest acidity cows.

In addition, samples were collected at the same time, and after being kept at similar temperatures were examined 8, 15, 48, and 72 hours after. No increased acidity was shown in the case of milk from silage-fed cows over that of cows fed without.

The conclusion to be derived is that silage does not cause milk to "sour" more rapidly.

RAINFALL IN VICTORIA.

Second Quarter, Year 1919.

Prepared by H. A. Hunt, Commonwealth Meteorologist.

District.		April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
Mallee North	Amount	49	224	67	340
	Average	61	116	139	316
	Per cent. Departure	−20	+93	−52	+8
Mallee South	Amount	59	202	92	353
	Average	91	132	172	395
	Per cent. Departure	−35	+53	−47	−11
North Wimmera	Amount	20	175	93	288
	Average	111	164	208	483
	Per cent. Departure	−82	+7	−55	−40
South Wimmera	Amount	20	176	132	328
	Average	152	197	270	619
	Per cent. Departure	−87	−11	−51	−47
Lower Northern Country	Amount	80	217	127	424
	Average	109	171	220	500
	Per cent. Departure	−27	+27	−42	−15
Upper Northern Country	Amount	74	203	132	409
	Average	145	193	264	602
	Per cent. Departure	−49	+5	−50	−32
Lower North-East	Amount	140	269	248	657
	Average	170	257	388	815
	Per cent. Departure	−18	+5	−36	−19
Upper North-East	Amount	190	342	431	963
	Average	266	373	597	1,236
	Per cent. Departure	−29	−8	−28	−22
East Gippsland	Amount	211	517	117	845
	Average	240	246	308	794
	Per cent. Departure	−12	+110	−62	+6
West Gippsland	Amount	161	303	437	901
	Average	288	303	349	940
	Per cent. Departure	−44	...	+25	−4
East Central	Amount	108	205	364	677
	Average	274	306	341	921
	Per cent. Departure	−61	−33	+7	−26
West Central	Amount	51	253	184	488
	Average	192	214	244	650
	Per cent. Departure	−73	+18	−25	−25

VICTORIAN RAINFALL *continued.*

District.		April.	May.	June.	Quarter.
		Points.	Points.	Points.	Points.
North Central	Amount	73	249	247	569
	Average	185	253	334	772
	Per cent. Departure	−61	−2	−26	−26
Volcanic Plains	Amount	22	229	189	440
	Average	183	224	264	671
	Per cent. Departure	−88	+2	−28	−34
West Coast	Amount	39	284	361	684
	Average	241	202	352	795
	Per cent. Departure	−84	+41	+3	−14

N.B.—100 points = 1 inch.

AUSTRALIAN WHEAT SUCCESSFULLY GROWN IN INDIA.

Federal wheat, imported into India from Australia, has proved very successful of late years, and has successfully challenged the supremacy of the local varieties. According to an Indian paper, nearly 40 maunds (about 52 bushels) of grain per acre of Federation has been harvested from a 10-acre field at the Peshawar agricultural station. One acre, which was irrigated once only after the seed was sown, yielded fully 53 bushels. This is regarded as India's record crop, and is in strong contrast to India's average yield of 16 bushels on irrigated land. The highest average of any country in the world is 33 bushels, obtained in England.

The land that gave this fine crop at Peshawar was not exceptionally rich nor had it been manured for the wheat or for the clover that preceded it. In short, the big yield was obtained by clean, careful cultivation, and chiefly, to quote the report, "by the high-yielding power of the variety of wheat that was grown."

At Peshawar Federation ripens as early as any local variety; it resists drought, does not suffer much from rust, and holds its grain long after the ears are quite ripe. And, although it is one of the very few stiff-strawed wheats that can be depended upon to stand up in any weather when the crop is over 25 bushels per acre, it is considered to yield a soft, "cellulose" straw rather than a harsh "siliceous" one.

The variety was first tried at Peshawar in 1913, and since then it has yielded an average of nearly 49 bushels per acre in the farm trials, and on the seed areas. It is reported to have yielded well at Pusa this harvest. Some years before it was tried at Peshawar it was found inferior to the Punjab wheats on the light, sandy loam of the

Lyallpur agricultural station. Federation, so far, has done best in India on fairly heavy land, and, unlike many wheats, it responds bountifully to good cultivation. In the neighbourhood of the Peshawar agricultural station several cultivators have harvested over 30 maunds (40 bushels) per acre of Federation, and in one valley of the north-west frontier province it is estimated that 1,000 acres of it were sown this season.

—*The Farmer and Settler*, New South Wales, 29.7.19.

WHITEWASH AS A PAINT SUBSTITUTE.

A whitewash that is almost as serviceable as and cheaper than the cheapest paint for wood, brick, or stone, has been used by the United States Government for whitewashing lighthouses. It has also been used to embellish the east end of the White House in Washington. The whitewash is made as follows:—

Slake half-a-bushel of lime with boiling water, cover during the process to keep in steam, strain the liquid through a fine sieve or strainer, and add to it a peck of salt, previously dissolved in warm water, 3 lb. of ground rice boiled to a thin paste, and stirred in while hot, ½ lb. of Spanish whiting, and 1 lb. of clear glue previously dissolved by soaking in cold water, and then hanging over a slow fire in a small pot hung in a larger one filled with water. Add 5 gallons of hot water to the mixture, stir well, and let it stand a few days, covered from dirt. It should be applied hot, for which purpose it can be kept in a kettle or portable furnace. By the addition of colouring matter various shades of colour can be obtained. The colouring matters generally used are ochre, chrome, Dutch pink, raw sienna for yellows and buff, Venetian red, burnt sienna, Indian red, or purple brown for reds; celestial blue, ultramarine, indigo for blues; red and blue for purple grey or lavender; red lead and chrome for orange; Brunswick green for greens; yellow ochre added to the whitewash gives a cream colour; lamp-black or ivory black produces a pearl or lead tint; 4 pounds of umber to 1 pound of Indian seed and 1 pound of lamp-black makes fawn, and 4 pounds of umber and 2 pounds of lamp-black produces the common stone colour.

—*The Wednesday Review* (India).

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.L.S., Pomologist.

The Orchard.

CULTIVATION.

Orchard ploughing should now be finished, and the main work for the next few months will be an endeavour to keep the soil surface loose, friable, and well opened. The consolidation of the surfaces must be

avoided, as a hard, compact surface means the loss of much soil moisture, by capillary attraction. So that after rains, heavy dews, the spray pump and other traffic, it will be as well to run the harrows over the surface of the soil, so as to keep the surface well broken and to maintain a good earth mulch. If the harrows are not sufficient to break the clods, a spiked or heavy roller should be drawn over it, and then harrowed. If the weather is at all dry it is advisable to plough only as much as may be harrowed in the same day. By immediately following up the ploughing with harrowing a minimum amount of moisture is lost by capillarity.

Green manure crops should now be ploughed under, and should they be very abundant in growth, a roller should be run over them and ploughed with a coulter attached. Any of these means will serve to get the crop underground, which is a desideratum.

In addition to the retention of soil moisture, cultivation of the orchards will suppress the weeds which rob the trees of food and moisture. The suppression of weeds is an important work in the spring and summer, and they should be rigorously hoed or cultivated out.

Spraying.

Spraying for all pests and diseases is, at this time of the year, an important work in the orchard. Bordeaux or lime sulphur spraying for the black spot of apples and pears, for scab and shothole in peaches and apricots, for the leaf curl of the peach and rust of the plums and peaches, should now be completed.

Where there are indications that previous sprayings have not been thoroughly successful, a weak lime sulphur spray should be given.

Wherever they are present, nicotine sprays should be given to combat the peach aphis, and the pear and cherry slug. For the latter pest, arsenate of lead should not be used if the cherries are within a month of ripening. Arsenate of lead is so tenacious, and thus it is likely to remain on the fruit until it is ripe, when it would be dangerous to the consumer. Thus, while this property of remaining on the fruit for a considerable time is of great value in the Codlin Moth spraying, it is quite of the opposite value when used for the pear and cherry slug. Either tobacco water or hellebore is useful for the eradication of this pest, as these substances do not remain long on the trees, and they are quite as effective as arsenate of lead.

Codlin moth spraying, too, will be in evidence this month. Owing to the early season, it is possible that the development of the moth will take place earlier. It is generally assumed that the appearance of the moth is coincident with the bursting of the flowers. This is not always so—the moths frequently come slightly later than the blooming period. Owing to the rapid expansion of the fruit, it is well to follow the first spraying with a second in a week or ten days' time. Arsenate of lead is still the spray for the Codlin moth, nothing having been found to supersede it.

Vegetable Garden.

A good tilth, and a well-pulverized soil, are the main soil necessities in the vegetable garden this month. Frequent cultivations will keep in the soil moisture, and will obviate the necessity for surface waterings. At the same time, it should be remembered that the vegetable garden requires more water than the flower garden, owing to the quick growth of the plants. Quickly-grown vegetables are more tender and more luscious than slowly-grown ones: thus a good water supply will need to be maintained. Weeds are great moisture-robbers, and they should be kept out of the vegetable garden at this time of the year.

Late plantings of tomatoes may now be carried out; all early-planted plants should be fed, staked, and the laterals pinched back. A little bone-dust or superphosphate may be given, but these are not equal to animal manures, if the latter are available. Chemical manures should only be given in limited quantities, 6 or 7 cwt. per acre would be a heavy dressing, and this works out at nearly 3 ozs. per square yard. Vegetable growers may easily try this for themselves, and it will soon be seen that 3 ozs. scattered over a square yard of surface will appear to be a very light dressing.

French beans, carrot, parsnip, celery, radish, peas, and turnip seeds may now be sown. Seeds of cucumber, melon, and pumpkin family may now be sown in the open ground. All seedlings may be transplanted on favorable days, and it will be well to sprinkle the tops as well as to water the roots.

Asparagus beds may be top-dressed with manure, and kept well weeded. Such weak growths that are not gathered for eating should be cut out of the beds.

Flower Garden.

Flower gardens are troubled with many pests at this time of the year. Rose aphis is one of the most prevalent; frequent applications of tobacco water will keep this pest in check. The hot winds should not be waited for so as to rid the garden of the pests, because a great deal of damage is done before the hot winds come. They should be sprayed in any case.

Rose mildew will also need combating. This may be done by dusting the bushes with sulphur while they are wet with the morning dew. The ground may also be sprinkled, as the fumes check the fungus.

Leaf-rolling or leaf-eating insects will need to be sprayed with arsenate of lead or Paris green.

The surface should be kept well hoed so as to conserve the moisture, especially after the frequent waterings that should be given.

Chrysanthemums may be planted in soil that has been dug over two or three times, and each time digging in manure. The soil must not be too rich, but must be well drained.

Bulbs that have lost their foliage may be lifted, but do not cut the foliage, as this means loss of sap and energy.

Asters, zinnias, salvias, balsams, amaranthus, celosias, &c., lobelia, bedding begonia, iresines, alternantheras, &c., may now be planted out for summer and autumn flowers.

REMINDERS FOR NOVEMBER.

LIVE STOCK.

Horses.—Continue to feed stable horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses. Feed old and badly-conditioned horses liberally. If too fat, mares due to foal should be put on poorer pasture. Turn out workers due for a spell at grass. In view of sand trouble this year horses which have been paddocked all the winter should not be put to work until properly conditioned and any sand accumulation got rid of. A course of three or four bran mashes, after a twelve hours' fast, followed by 1 to 1½ pints of linseed oil, is helpful. Repeat in two or three days, if necessary. Colts to be gelded should be operated on before hot weather sets in.

Cattle.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw, if possible, to counteract the effect of green grass. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a dry shed and a good grass run. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Feed regularly with regard to quantity and time. Give a cup of limewater in the milk to each calf, also place crushed oats or lucerne hay in a trough so that they can eat at will.

Pigs.—Supply plenty of bedding in well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run. Sows suckling young should be well fed to enable them to produce plenty of milk. Give young pigs pollard and skim milk in separate trough as soon as they will take it, and keep them fattening from the start to get them off as early as possible. Give a tablespoonful of bone meal, or half that amount of mineral phosphate per 100 lbs. live weight in food daily. If pigs are lousy dress them with kerosene emulsion or sulphur and lard, rubbing well into crevices of skin, and disinfect styes. Pig breeding and feeding should be very profitable for a long time to come, and it should be safe to launch out now.

Sheep.—Prepare for dipping. Ascertain exact contents of bath before mixing. Powder or paste dips have the most lasting effect, particularly where lice have been bad. Hold sheep in the bath not less than half a minute: if badly infested, longer. Submerge heads twice, but allow them to rise quickly—most deaths after dipping are due to gross carelessness in holding sheep under too long, the dip wash being taken in on to the lungs. Dip rams and full grown sheep first, while bath is full, lambs last. Yard sheep over night. Dip while empty, and avoid fouling the drainer. Commence early in the day, and allow sheep to dry before nightfall. Avoid travelling long distances to and from baths, and dipping sheep while overheated. Do not roughly throw sheep in. Avoid filthy baths; this increases a dead tip in hot areas.

It is unsafe, and against instructions, to use powder dips in increased strength. Sheep badly lice-infested should be dipped directly off shears, and again in six weeks' time. Sheep with over a reasonable amount of wool on should be dipped at less strength than given on instructions.

When constructing new dips, remember moderate-sized ones are most economical, just as efficient, and can be more easily emptied as they become fouled, and if they are near water can be quickly filled.

Poultry.—Provide plenty of green food and shade. Watch for vermin: spray crevices of perches and houses with crude carbolic acid, 1 in 50. Keep water clean and cool, and out of the sun. One packet of Epsom salts should be given to thirty birds through the mash. Remove all male birds from the flock. Infertile eggs are preferable when pickling, or when placed in cool storage.

CULTIVATION.

Farm.—Plant main crop of potatoes. Cut hay and silage. Weed early potatoes. Sow maize and millets. Weed tobacco beds, and water, if dry.

Orchard.—Ploughing, harrowing, and cultivating to be continued. Weeds to be kept down. Secure, pinch, and spray grafts with water. Spray frequently for codlin moth, pear and cherry slug, and peach aphis. Plant out citrus trees.

Vegetable Garden.—Hoe and mulch surface. Suppress weeds. Water where dry and hoe afterwards. Disbud and pinch back tomato plants. Sow French beans, peas, lettuce, cucumber, melon, &c., seeds.

Flower Garden.—Water and mulch. Cultivate and keep down weeds. Thin out weak wood from roses. Prune early all flowering shrubs that have finished flowering. Lift and store bulbs. Plant out chrysanthemums. Liquid-manure herbaceous perennials.

Vineyard.—Field grafts require careful attention in the way of removal of suckers and scion roots. (See *Journals* for September and October, 1918.) Keep a sharp look out for Downy Mildew, and commence spraying on the appearance of the very first symptoms of the fungus. Though mildew only showed up in one or two localities last season, the fungus is not dead, but dormant; heavy rain in late October or early November is certain to lead to its reappearance. In the absence of spraying a visitation as disastrous as that of 1917-18 is by no means impossible. Even if the fungus is not visible, spraying should be concluded by the beginning of November in the north, and a week later in the cooler districts. Reprints of articles on this fungus obtainable on application. Cultural work, such as scarifying and hoeing, should be actively pushed forward, so as to provide as good a "mulch" as possible during summer. Proceed with tying up, stopping and topping. Avoid excessive topping, summer pruning being usually more injurious than useful in warm, dry climates. Cincture Zante currant vines after flower caps have fallen. Apply second sulphuring just before blossoming, wherever Oidium was prevalent last year.

Cellar.—Same as last month.

The Food Investigation Board appointed by the British Department of Scientific and Industrial Research has established an expert committee to investigate the question of the methods in use for preserving meat for human consumption, and especially to consider what improvements are possible in the preservation of beef during its transit from Australia and New Zealand to Great Britain. It has long been known that, whereas mutton can be frozen without impairing its qualities, beef needs much more careful treatment. Freezing in the ordinary way by cold air causes a separation of fluid in the substance of the muscle fibres, with the result that on thawing, unless somewhat elaborate precautions are taken, there is a loss of water and soluble constituents, and the texture of meat is impaired. The committee, therefore, decided to set up an inquiry into the cause of the peculiar sensitiveness of beef to freezing. The work as a whole is under the general supervision of Professor W. M. Bayliss, F.R.S., the laboratory work being conducted in his laboratory at University College, London, where a special experiment plant for investigations at low temperatures has been installed. For large scale experiments a cold store has been acquired in the north of London.